

THE ONSET OF CANONICAL BABBLING
IN ENVIRONMENTALLY AT-RISK INFANTS

BY

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This research is dedicated to the memory of my father, Mr. Clarence W. Myers, who died on March 28, 1992. It was the desires of his heart that his children strive for excellent and make worthwhile contributions. As my advocate and supporter, it was his dream to see me reach this milestone in my life. It saddens me that he was not granted that privilege, but through his great strength, integrity, and perseverance, an unforgettable legacy was left with me. "The just man walketh in his integrity: his children are blessed after him," Proverbs 20:7.

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The development of communication skills begins in infancy, before the emergence of first words. Any delay or disability that influences a child's early communication development is likely to have an effect on the child's subsequent personal, social, academic, and vocational life. The purpose of this study was to determine the age of onset of canonical babbling in infants who are environmentally at risk. A group of 41 environmentally at-risk infants were included to answer two questions: (1) How many at-risk infants began to babble by 10 months, the upper end of the normal age range for the onset for canonical babbling? and (2) Of those infants who did not begin to babble by the expected age, at what age did the onset of canonical babbling occur?

A battery of tests, checklists, and interviews was used to determine if the 41 infants were normal in aspects other than environmental risk. Parents and

caregivers were trained to recognize possible canonical babbling and to call the researcher to tape and confirm the onset of babbling. Tapes of the infants were then transcribed by two listeners and analyzed to determine the canonical babbling ratio.

The results indicated that about half of the infants began babbling after the expected age. The other half began babbling during the period predicted for normal babies, 6 through 9 months. These results were discussed in light of other research and of their implications for further research and the improvement of infant care programs. The importance of identifying and intervening with at-risk infants was stressed.

CHAPTER 1 INTRODUCTION AND REVIEW OF LITERATURE

Introduction

Effective communication is fundamental to all aspects of human functioning. The development of communication skills begins in infancy, before the emergence of first words. Any delay or disability that influences a young child's early communication development is likely to have a significant effect on the child's subsequent personal, social, academic, and vocational life. In recognition of this fact, speech-language pathologists and audiologists are increasingly involved in the delivery of communication intervention services to younger and younger children. The early years are crucial for all aspects of human development; therefore, it is important to know about the experiences of infants and toddlers in many areas of their lives. National data (National Center for Clinical Infant Programs, 1986) reveal that whereas most of our nation's children begin their lives in healthy, secure circumstances, some of our children do not. An infant who enters life facing one form of risk to healthy development, often faces multiple biological and environmental risks of varying kinds and severity. Distinguishing children who will develop problems from those who will not is a difficult task. Ideally, skilled professionals would have adequate time and resources to do the job. Realistically, those infants with severe handicapping conditions may be

identified soon after birth, but those with mild to moderate delays may not be identified until they enter school. Early identification of these infants and young children may benefit not only the parent and the child but the school and the community as well. For early identification to occur, an awareness of the effect of the environment on infant developmental milestones is vital.

Medical technology has made possible the survival of an increasing number of infants who previously would not have survived a precarious neonatal period. With the advent of neonatal intensive care nursery facilities, both national and international medical personnel have become interested in methodologies to reduce factors that may potentially contribute to developmental delay while children are still in the nursery. A vast quantity of information about the medical-at-risk infant is available to us. Factors that are known to contribute to greater perinatal loss and greater risk of developmental delay for those surviving infants have been presented in a variety of formats. Personnel in hospital settings are being asked with increasing frequency to participate in clinical services, joint research efforts, education of parents and other professionals, and developmental follow-up activity with at-risk infants. As a result of this knowledge, many changes in public education have taken place, and many professionals have taken unique positions to aid in the ongoing evolution of services to at-risk infants. Although only a minority of clinicians and educators are currently involved in providing services to this population, interest is clearly growing as an increasing number of states are mandating services to younger and younger children.

A review of the data (National Center for Clinical Infant Programs, 1986) assembled about the status of American infants and toddlers suggests that there are gaps in available information about children from birth to 3. Whereas an enormous amount of information is available on "high risk" infants or infants who are biologically or medically at-risk, the infants who are considered normal at birth are not followed as closely. It is important to know circumstances of their families, the risks to life and health they face in the first years of their lives, the family and community environments in which they develop, and the sources of health care available to them during the early developmental stages.

Therefore, it is important to study the effects of early experiences on development. Speech-language pathologists and audiologists are professionals who should have a role in prevention, early identification, assessment, and intervention with infants at risk for communication disorders. Currently, these services often are performed by other professionals or not at all. Speech-language pathologists are becoming more aware of the environmental risk factors in early development, but little information about their contributions or influences on communicative development is available.

One possible predictor of later speech and language development may be the age of onset of canonical babbling. Canonical babbling is a stage in vocal development that is characterized by consonant and vowel reduplicated syllables, e.g., [mamama], [dadada] (Gesell & Armatruda, 1941; Nakazima, 1962; Smith & Oller, 1981) whose timing approximates that of adult speech. The onset of

canonical babbling in normal infants (Oller, 1978; Stark, 1980; Zlatin, 1975) and in some special populations (Brown, Bendersky, & Chapman, 1986; Menyuk, Liebergott, & Schultz, 1986; Oller, Eilers, Bull, & Carney, 1985; Oller & Seibert, 1988) is known. However, as with other developmental skills, the effect of the environment on babbling is not known. Thus, the purpose of this investigation is to examine the age of onset of canonical babbling of infants who are environmentally at risk.

Review of the Literature

Vocal Development

At birth the infant's only vocalization is crying. During the first year, children move through several stages while developing the ability to produce a variety of speech-like sounds. Each stage is related to its predecessors in a coherent way. The orderly progression of each stage appears to have certain universal aspects. However, individual differences are found within each stage of development and possibly in the degree of overlap of behaviors deriving from one stage and those that are characteristic of its successors. The stages of development of speech sound production have been described by three investigators working independently (Oller, 1978; Stark, 1980; Zlatin, 1975). Although each investigator used unique descriptors for each stage, there were no fundamental contradictions. The investigators did not disagree about the sound types heard during extensive longitudinal and cross-sectional investigations of infant sounds. Differences in the interpretation of sounds and their implications on emerging

intellect, motoric development, and specific speech practice were more a matter of varying focus than of differing philosophies. Consequently, a synthetic stage model incorporating the descriptive characteristics of each of the three investigators was constructed (Oller, in press) and is used in the following section.

Stage Models of Infant Vocal Development

The models of Zlatin (1975), Stark (1980), and Oller (1978, 1980) were formulated in the mid 1970s. Zlatin focused on cognitive/sensorimotor development; Stark focused on vocal development as a motoric phenomenon and saw speech emerging from other vegetative sounds; Oller sought to characterize the systematic emergence in infant sounds of general characteristics of vocal production that would be manipulated in later meaningful speech. Each of the investigators used the concept of stages as approximations and emphasized that ages could vary substantially across individuals.

Stage 1 (Approximately birth to 1 month)

During the first stage, reflexive sound making is most certainly apparent. Infants cry, burp, sneeze, cough, and hiccough. Stark, in particular, emphasized that these sounds are a part of the general vocal capability of the organism, and she sought to find the origins of speech development therein. The sounds that Oller referred to as "quasi-resonant or quasi-vocalic nuclei" were referred to as "vegetative" by Stark and Zlatin. It is not clear whether these sounds are produced intentionally by the infant, but it is not surprising that they would be called "vegetative" because they resemble very low intensity, mid-pitch grunts.

Oller's quasi-resonant nuclei (QRN) include normal phonation (not vocal fry, not breathy voice, etc.) but do not involve any systematic contrast between opening and closure of the vocal tract and do not make use of the full potential of the vocal cavity's function as a resonating tube. The limited resonance of the elements gives the category its name. Utterance duration is commonly a few hundred milliseconds, roughly consistent with the timing that is seen in real speech syllables. Acoustic analysis of the QRN has shown it to consist of a broad band of low amplitude resonances primarily below 1200 Hz (Murai, 1963; Nakazima, 1962; Oller, 1986). Auditory phonetic analysis has suggested that QRN's range from a syllabic nasal to a high, mid, unrounded, nasalized vowel (Doyle, 1976; Oller, 1986). In QRNs infants seem to phonate with their mouths closed or nearly closed.

Another important vocalization that is clearly reflexive at this stage is crying. Crying is patently unlike speech in its phonation and timing pattern, as indicated in numerous studies. An intense cry is specifically noted to have considerable "dysphonation" or noisiness that is seen spectrographically as interharmonic fill (Truby & Lind, 1965; Wasz-Hockert, Lind, Vuorenkoski, Partenen, & Valanne, 1968), and its timing includes segments that are tied to the breathing cycle in specific ways and to an extent that speech is not (Lester, Corwin, & Golub, 1988). Furthermore, the pitch range of crying is greater than would commonly be expected in speech; whereas the pitch of quasi-resonant sounds gives the impression of being precisely that of speech. The quasi-resonant

sound is like speech in range and in mean value if the characteristics of the infant's vocal tract and larynx are taken into account. The quasi-resonant sound may be thought of as quasi-vocalic—a vowel-like sound produced with the vocal tract at rest, often closed. Quasi-resonant sounds are not judged by the listener as well-formed nuclei. Oller (1980) suggested that during the first stage, the baby's vocalizations indicate the consistent production of at least one sound category and manifest his ability to control phonation, one critical parameter of speech.

Stark (1980) and Zlatin (1975) emphasized that during the first months of life, many glottal stops and glottal fricatives occur. It appears that many of these glottal sounds occur as onsets, offsets, and interruptions in the quasi-resonant utterances. Such occurrences may be further suggestive of the infant's developing control over consistent phonation. Irwin and Chen (1946) in their transcriptions of early vocalizations had also noted the occurrence of "h's". Their historic observation seems, in the present perspective, to have stood the test of time.

Stage 2 (Approximately 2 to 3 months)

The second stage is characterized by the emergence of laughter and by the development of articulatory skills in what Zlatin called "primitive syllables." The word primitive is emphasized because the utterances appear to be less regular in the timing of their openings (QRN) and closures (velar consonant-like elements) than syllables normally are in mature languages. Because these primitive syllables often have posterior consonant-like articulations, they have been called "coos" and/or "goos." The articulations are various, including fricative-like, stop-like, and

glide-like patterns, and the constrictions are not always at the back of the mouth. Many are labial; some appear to be apical-coronal (produced with the front of the tongue). It is not clear how the back sounds are articulated. The velum, the uvula, the pharyngeal wall, and the epiglottis have all been implicated (Kent, 1981).

The alternation between quasi-resonant sounds and consonant-like articulated sounds inspired Zlatin to note the similarity between these infant vocal acts and mature syllabic articulations. Oller (1980) also was impressed with the similarities between the infant sounds and speech, despite the fact that the nuclei in infant gooing were most commonly quairesonant. In speech, the most commonly occurring syllables have "fully resonant or fully vocalic" nuclei. The vocal tract is not at rest, but rather assumes a shape that is maintained while normal phonation is produced, yielding a clear vowel-like quality. The vowel-like quality of fully vocalic sounds includes resonance patterns that tend to contrast effectively with the resonances of consonantal closures. The combination of fully vocalic sounds and consonant-like sounds makes possible clear and highly differentiable formant transitions between consonants and vowels. This is the pattern of most mature syllables, but it is notably not present in most "primitive syllables" of Stage 2.

Oller (1986) referred to Stage 2 as the precanonical "goo stage." The gooing indicates that the infant is capable of producing significant variation in the sound as a result of articulation. The nuclei are not usually fully resonant, margin-to-nucleus intensity difference is insufficient, and formant transitions may violate

the timing or intensity change requirements of canonical syllables. This represents a partial mastery of aspects of both syllable nuclei and syllable margins.

Stage 3 (Approximately 4 to 6 months)

In the third stage of vocal development, babies explore a variety of articulation capabilities and the vocal manipulations needed for many new parameters. This stage has been described as an expansion stage by Oller and Smith (1977) and as an exploratory mapping stage by Zlatin (1975) who quoted Mattingly (1973) in support of this view. Infants squeal and growl, apparently exploring the pitch parameter. They yell and whisper, manipulating the amplitude dimension. They produce a wide variety of fully vocalic sounds, exploring the potential vowel space (Buhr, 1980; Kent & Murray, 1982; Lieberman, 1980; Lieberman, Buhr, Keating, Hamby, & Landahl, 1976). The infant also produces a wide variety of articulations including labial fricatives, trills, and vibrants. The infant's development of these sounds indicates an emerging control over a variety of parameters that must be controlled in mature speech (Oller, 1980).

A characteristic that was noted by all of the investigators was the repetitive action involved in the playful use of a particular sound or in apparent practice. Three terms were used to describe the stage: vocal play (Stark, 1980), exploratory mapping (Zlatin, 1975), and expansion of capabilities (Oller, 1977). Oller (1980) proposed that the playful exploration of the infants at this stage suggests intentionality, but he left open the question of whether the infant has a goal in the use of sounds that resemble speech. These utterance types involve a pitch

range from as low as 100 Hz in growling to over 1000 Hz in squealing, a more than 10-fold range.

Toward the end of this stage an increase of occurrence in a new type of primitive syllable is commonly seen. In these "marginal syllables" the infant produces a consonant-like articulation and a fully vocalic nucleus but fails to produce the kind of timing that is normally seen in mature syllables. The transition from consonant to vowel is too slow, and consequently the syllable sounds aberrant. It is apparent by the end of this stage that the infant is on the verge of producing syllables that could be called "well-formed" or "canonical," the kind of syllables that had been deemed transcribable in early infant studies because of their resemblance to speech.

Stage 4 (Approximately 6 to 10 months)

The onset of canonical babbling, especially reduplicated canonical babbling, is often relatively clear and salient even to the unsophisticated listener. Infants seem to say "bababa" or "dadada," and parents sometimes mistakenly think the baby has actually learned to communicate with words. This impression is understandable because the baby has begun to produce vocalizations that are similar to the syllables of natural languages. In many instances the reduplicated or single syllable canonical babbles are pronounced in such a way that, if they were properly coordinated with meaning, would indeed constitute true speech.

Stark's emphasis on motoric development led her to see reduplicated babbling as a general rhythmic motor development. This position is clearly

plausible in the context of data on the development of other rhythmic acts (kicking, hand banging, etc.) that have been described by Thelen (1979) and seem to show comparably sudden onsets. Ramsey (1984) showed an association between the onset of canonical babbling and the onset of handedness in human infants.

During Stage 4 of vocal development, infants are capable of considerable variation in vocalization. The fact that various sound types, which were developed during exploratory mapping of the previous stage, are brought together in a smooth fashion in the canonical stage can be taken as an instance of coordination (Oller, 1980). The babbling is characterized by a series of consonant-vowel (CV) syllables, with each syllable perceived as being similar to every other. It resembles speech much more closely in its timing than the vocal behaviors found in any previous stage.

The formal characterization of the nature of canonical syllables became a critical goal for investigators during the 1980s. It became clear that with a formal characterization, it would be possible to evaluate gradations of speech-like quality or "speechiness" that had been previously inaccessible. In a work by Oller (1986), the acoustic characterization of canonical syllables was described in the context of a model that was termed "metaphonological." Metaphonology specifies how acoustic parameters (frequency, resonance, intensity, and timing) are manipulated to generate well-formed, concrete phonetic units in any natural spoken language. The syllable has a power envelope with peaks (nuclei) and valleys (margins)

differing by at least 10 dB. The peak-to-peak duration in canonical syllable strings cannot be less than 100 ms (for very low-stressed syllables) and not more than 500 ms (in very slow, deliberate speech). The nucleus of a canonical syllable has a periodic energy source and relatively open vocal tract to yield full resonance and at least one margin of low resonance and relatively closed vocal tract. The transition between canonical syllable margin(s) and nucleus involves a smoothly changing frequency, intensity, and resonance pattern. Transition durations fall within specifiable limits—25 to 120 ms. Both the intensity and frequency ranges of speech sounds are limited; the intensity range is equal to or less than 30 dB and the frequency range is at least two-fold. Because metaphonology attempts to account for the underpinnings of phonological systems, the tacitly known rules that form the building blocks of speech systems, this model has more recently been called an "infraphonological" model (Oller & Lynch, 1989).

Infraphonology is in its own kind of infancy, because only "canonical syllables" have been characterized. These represent the minimal rhythmic units of natural languages. Oller (in press) proposed future plans to characterize infraphonological patterns defining a variety of additional levels of rhythm, e.g., the metric foot, the phrase, the utterance, the discourse unit. Additional specification is needed even in the domain of the syllable. In the meantime, it is clear that the notion of canonical syllable is not illusory, but rather quite easily defined. The model points out the potential importance of canonical syllables as indicators of an emerging ability to produce the sounds of speech.

Stage 5 (Approximately 10 to 14 months)

In Stage 5 the productions are still primarily CV sequences, as in the previous stage, but now the reduplicative nature of the utterances is no longer present, and a variety of consonants and vowels can co-occur, e.g., [bawidu] (Oller, 1980). This type of utterance is referred to by Oller as variegated babbling. During this stage the consonantal repertoire increases substantially. A second characteristic of this stage is the presence of adult-like intonation patterns. Parents often believe their children are producing whole sentences—statements, questions, exclamations—but in their "own" language.

Studies of Vocalization of Special Groups

Many have assumed that babbling gradually approximates the phonological patterns of the language (Locke, 1983; Oller, Weiman, Doyle, & Ross, 1975; Stoel-Gammon & Cooper, 1984). Because the phonological preferences of the child tend to center on commonly occurring speech sound categories, there is a tendency for children all over the world to produce the same kinds of sounds. This tendency has been noted repeatedly in general reviews of studies representing a wide variety of languages (Locke, 1983). Given that there are obvious important similarities among infant babblers all over the world, it is intriguing to ask whether or not there may be differences. There has been a wide variety of studies that have attempted to find differences with little success (Atkinson, MacWhinney, & Stoel, 1970; Eady, 1980; Eilers, Oller, & Benito-Garcia, 1984;

Oller & Eilers, 1982; Olney & Scholnick, 1976; Preston, Yeni-Komshian, & Stark, 1967; Thevenin, Eilers, Oller, & LaVoie, 1985).

Oller (in press) summarized efforts made by Benedicte de Boysson-Bardies and her colleagues in France on subtle differences between the babbling of French, English, Arabic, and Chinese babies. In a series of studies Benedicte de Boysson-Bardies and her colleagues found that a French baby in the middle of the second year of life, produced babbled sounds that resembled French more closely than English or Thai (de Boysson-Bardies, Sagart, & Bacri, 1981). The adult listeners could recognize French babies (6-10 months of age) as distinct from Arabic or Cantonese babies based on babbling sounds alone (de Boysson-Bardies, Sagart, & Durand, 1984). The 10-month-old French, Arabic, and Cantonese babies seemed to attune their vocal productions to long-term spectral characteristics of their language community (de Boysson-Bardies, Sagart, Halle, & Durand, 1986). The vowel formants of infants from French, English, Arabic, and Cantonese families were similar to characteristics of the formants occurring in the language of the individual infant (de Boysson-Bardies, Halle, Sagart, & Durand, 1989).

Oller (in press) concluded that the French studies did not find that it was easy to distinguish between the babbling of infants from different language communities but that, with sufficient care and the knowledge of how to look for the differences, differences can be found. The clearest differences were seen in the realm of vowel production, an area that has been investigated far less than

consonant production since the advent of the modern era in infant vocalization research. If the results of the French studies stand the test of time, they will indicate that language listening experience plays a role in the form of infant sounds at a very early age (Oller, in press).

In the last decade, a new view has been achieved in the study of the babbling of deaf infants, a view that was impossible in the context of earlier less-sophisticated models. The earlier studies had suggested that deaf infants "babble" just as hearing infants do, although the deaf infants have been thought to vocalize less (Appleton, Clifton, & Goldberg, 1975; Fry, 1966; Holmes & Morrison, 1979; Vander Zanden, 1981). Stoel-Gammon and Otomo (1986) and Stark (1972) indicated that on closer examination with sophisticated transcriptional tools, the babbling of deaf infants in the first and second year of life differs notably from that of hearing infants. Working in the infraphonological framework and focusing on the onset of the canonical stage in infants, Oller et al. (1985) and Oller and Eilers (1988) have shown that deaf infants are drastically delayed in the onset of canonical syllable production. Whereas hearing infants virtually always enter the canonical stage prior to 11 months of age, deaf infants almost never do. In the Oller and Eilers (1988) study, the role of auditory experience in the development of the phonological and metaphonological capacities was examined. "The metaphonological perspective takes account of the articulatory/acoustic patterns of speech sounds in all mature spoken languages. Auditorially, canonical syllables were identified by phonetically trained listeners as those having the following

properties: (1) at least one fully resonant nucleus (i.e., vowel of identifiable quality, high nasalized vowels being excluded by the resonance requirement); (2) one nonglottal margin (i.e., consonant other than glottal stop or glottal fricative), (3) duration of syllable and formant transitions that fit within the range of mature syllable production, and (4) normal phonation and pitch range." Oller and Eilers (1988) identified canonical babbling from tape-recorded sample of spontaneous utterances in the following way.

A 50 utterance minimum is commonly sought, and vegetative and/or presumed involuntary utterances (coughs, sneezes, cries, involuntary grunts, etc.) are excluded. A single utterance is defined as a "breath-group," with not more than 1 sec. of internal silence. For tape recorded vocal samples, an operational definition of canonical stage includes a .2 or greater ratio of the canonical syllable to utterances (Oller, 1984). The ratio is determined by simply counting the number of canonical syllables in a sample (in some cases, multiple canonical syllables occur within a single utterance) and dividing by the number of utterances in a sample. (p. 444)

Results indicated that from 8 to 13 months of age, the deaf subjects differed strikingly from hearing infants of comparable age. The deaf subjects produced no repetitive canonical babbling, whereas all the hearing infants produced many canonical syllables. The topography of the deaf infants' vocalizations resembled that of 4-to 6-month-old (i.e., expansion stage) hearing infants.

Oller (1988) suggested that these results have fundamentally altered our understanding of the role of listening experiences in the development of a phonological capacity. It now seems likely that listening plays a very major role in what the infant comes to pronounce in the way of syllables and, indeed, determines his/her ability to begin the process on schedule. The myth that audition

plays no role in normal babbling may be attributable in part to the fact that differences between the vocalizations of deaf and hearing infants are obscured by some important similarities. Both deaf and hearing infants produce many precanonical vocalizations that are substantially alike, among them raspberries, squeals, growls, etc. (Stoel-Gammon & Otomo, 1986). Also, the shift from back articulations of the gooing stage to the more front articulations of later stages appears to occur at similar ages in deaf and hearing infants (Smith, 1982). At the same time, it remains unclear exactly how similar the precanonical sounds of hearing and deaf infants are.

Other recent research has addressed the problems of early vocal development in children with Down syndrome and other mental handicaps. Dodd (1972) and Smith and Oller (1981) have indicated that infants with Down syndrome show similarities with hearing infants in the frequency and length of utterances, the number of different vowel and consonant types produced, the age of onset of canonical babbling, and the age of occurrence of the shift from predominantly back to predominantly front articulations. These findings have suggested that the level of intellect does not play a major role in the patterns of vocal development that are seen.

Oller and Seibert (1988) studied 36 prelinguistic children, 17 to 62 months of age, who were participating in a full-time stimulation program at the University of Miami's Mailman Center for Child Development. They were all engaged in training intended to accelerate cognitive, motoric, and linguistic development. No

specific speech therapy was provided in the program. Results suggested that older children with mental handicaps, 17 to 62 months, who were not speaking meaningfully usually produced a rich complement of canonical babbles, sufficient to suggest from a phonological or infraphonological standpoint that they were ready to speak. Children with mental handicaps who did not show canonical syllables in proportions resembling those of 11-to 13-month-old normal infants showed no sign whatever of emerging speech, whereas some of the children with mental handicaps whose babbling was similar to 11-to 13-month-old normal infants were beginning to use prereferential communication. The results suggest that an evaluation of canonical babbling can suggest whether or not the infant or child meets certain readiness criteria for the onset of meaningful speech.

Brown, Bendersky, and Chapman (1986) examined the utterances of infants born preterm in order to ascertain whether there were any differences in speech sound production between healthy preterm infants and those who had suffered trauma. Thirty-three infants whose corrected ages ranged from 9 months to 22 months were assessed. Twenty-one of these infants had suffered intraventricular hemorrhage (IVH); the remaining 12 had not suffered any trauma. The results showed that both groups of preterm infants were delayed in speech development when compared with developmental norms. The IVH children showed more serious delays than did the other preterm infants, and the range of delay was much broader. The range of delay suggested that a number of different factors may have been operating. These factors included trauma and differences

in interactive behavior with parents. With trauma, the locus of the hemorrhage and the maturity of the central nervous system at the time of the insult are associated factors. A hemorrhage and consequent ventricular dilatation that predominantly affects the left hemisphere may have a greater impact on speech-sound behavior than right hemisphere trauma. The less mature central nervous systems of the younger premature babies at the time of hemorrhage may have greater facility for compensatory remodeling. When considering the interaction, the 12 infants who had not suffered any trauma stayed in the hospital for a shorter period and suffered less severe medical complications than did the IVH infants. These infants were less at risk for problems of bonding with subsequent effect on attachment and interaction than was the IVH group.

Other Related Studies

A large number of published studies has dealt with the prediction of outcomes within the first few years of life using measures of perinatal and neonatal medical complications or deviance as predictors (Cohen, 1981; Goldstein, Caputo, & Taub, 1976; Hunt, 1981; Sigman, Cohen, & Forsythe, 1981; St. Claire, 1978). The most frequently used outcome variables were measures of cognitive and neurological/motor developmental functioning (Drage & Berendes, 1966; Field, 1981; Field, Hallock, Ting, Dempsey, Dabini, & Schuman, 1978; Hunt, 1981; Rubin, Rosenblatt, & Balow, 1973; Sigman et al., 1981). The overall finding from these studies is that infants who have suffered neonatal complications show significantly elevated rates of problems in physical, cognitive,

neurological, and motor developmental functioning during early childhood.

However, prediction of outcomes for individual children on the basis of type and severity of perinatal complications has not been very successful (Hunt, 1981; Sigman et al., 1981).

The most generally accepted explanation for the relative lack of predictive power of neonatal events is that later functioning of the individual child is determined both by the child's constitution and by the specific characteristics of the environment to which the child is exposed. With the exception of complications that result in debilitating disorders, the overall predictive power of environmental variables alone has been shown to be considerably stronger than that of constitutional variables (Broman, Nichols, & Kennedy, 1975; Caputo, Goldstein, & Taub, 1981; Sameroff, 1981; Sameroff & Chandler, 1975). One explanation of the above effect is that environmental variables are likely to constitute by far the strongest influence on development from the early childhood years. Whereas the impact of perinatal and neonatal variables often is directly observable from birth, environmental variables begin to show their impact gradually over the first years of the infant's life.

In studies using environmental descriptors to explain the dynamics of the developmental milieu, for example, quality of home or mother-child interaction pattern test scores have shown an early association with environmental variations (Beckwith, Cohen, Kopp, Parmelee, & Marcy, 1976; Yarrow, Rubinstein, Pederson, & Janowsky, 1972). Several states have started to track at-risk and disabled

infants during the first three years of life (i.e., Washington, Oregon, Missouri). The Polk County, Oregon, program (Johnson, 1989) addressed the need for monitoring the development of infants and young children designated at-risk. The high rate of poverty, single parenthood, teen parents, and unemployment created a need to monitor children for developmental delays due to environmental as well as biological risk factors. Distinguishing children who will develop problems from those who will not is a difficult task. Ideally, skilled professionals would have adequate time and resources to do the job. Realistically, those infants with severe handicapping conditions may be identified soon after birth, but those with mild to moderate delays may not be found until they enter school. Early identification of these infants and young children benefits not only the parent and child but the school and the community as well.

Polk County Infant Monitoring Project (IMP) was designed to effectively measure the development of infants from birth through age 3 without involving professionals or transporting the family to a test site. The IMP used questionnaires to assess developmental skills at various ages (Bricker, Squires, Kaminski, & Mounts, 1987). Simply worded questionnaires were mailed to the parents seven days before the child reached 4, 8, 12, 16, 20, 24, 30, or 36 months gestational age (corrected for prematurity when necessary). Both subjective and objective criteria were included to assist in identifying at-risk infants. Objective criteria included low birth weight, hospitalization, and genetic or congenital abnormalities. The subjective factors considered were parent apprehension about development and

family instability. Each questionnaire contains six or seven questions on development in each of five areas (domains). The domains were communication, fine motor, gross motor, adaptive, and personal/social. The results showed that certain risk factors are better predictors of developmental difficulties than others.

Grouping children from households with such factors as child abuse, suspect caregiver interaction, and concern with parenting abilities demonstrated the critical need for monitoring the developmental progress of these children.

Abnormal results were found most often for questionnaires sent to families with questionable parenting skills. Over one-third (38%) had abnormal questionnaires, and 14% exhibited delays serious enough to warrant intervention services (N=63). Other factors that placed children at-risk were teen parents, single parents, parents with two children born within 18 months, multiple births, and lack of or late prenatal care.

Current statistics (Walkins & Melnick, 1985) indicate that one-quarter of all babies born in the United States are born into poverty. One fifth are born to single parents. The United States infant mortality rate is higher than that of all other industrialized countries. There were more than five times as many births to single women in 1983 (737, 893) as in 1950 (142,00). Almost 37% of the 1983 births (270,000) were to unmarried teenagers. Children 3 years and under comprise 30% of the abused population but only 22% of the general population. More than 50% of all women with infants under age 3 were in the labor force in 1986. Approximately 70% of all infants and toddlers in out-of-home care by non-

relatives are in family day care. Over 70% of family day care is unregulated. Nineteen percent of family day care providers have an eighth grade education or less. Little is known about the speech and language development of children at-risk and especially children who are environmentally at-risk.

Summary and Statement of the Problem

The onset of canonical babbling is clear and salient even to the unsophisticated listener. Infants seem to say "bababa" or "dadada," and parents sometimes mistakenly think the baby has actually learned to communicate with words. Stark (1980) explained reduplicated babbling as a general rhythmic motor development in which the infant suddenly acquires mastery over this activity. The essential component to this new skill may be active control of opening the vocal tract at a point above the glottis.

Oller (1980) and Stark (1980) both agreed that canonical or reduplicated babbling, characterized by a series of consonant-vowel (CV) syllables with each syllable perceived as being similar to every other, begins between the ages of 6 and 10 months in normal babies. It resembles speech much more closely in its timing than the vocal behaviors found in any previous stage of vocal development. Although there is agreement about the general nature of the stages of vocal development and their order of succession, ways of discriminating the onset of each have not yet been clearly specified. The onset of certain stages, such as cooing, laughter, and reduplicated babbling or canonical babbling, appears to be

more clearly marked than the onset of others, such as vocal play or expansion and single word production.

Investigators have concluded that the onset of canonical babbling is delayed in several populations. Oller et al. (1985) and Oller and Eilers (1988) have shown that deaf infants reach the onset of canonical babbling much later than hearing infants.

Oller and Seibert (1988) studied prelinguistic children with mental handicaps, and found that most of them produced substantial numbers of canonical syllables. However, substantial variability in ratios was found. Values ranged from 0 to 1.59 canonical syllables per utterance. Twenty-nine children showed ratios of 0.2 or greater, a value that has been set as a minimum to indicate a canonical stage vocal pattern (Oller, 1984). The five children with the highest level of expressive language development—small vocabulary of prereferential spoken words—had the highest babbling ratios. The most potentially useful result of their study appeared to be the indication that the babbling ratio may help in the prediction of meaningful speech development. The addition of a babbling ratio factor to analyses of infant behavior may substantially increase the predictability of language development outcomes. Although children with high ratios may or may not talk, results from this study indicated that a child with a very low ratio is unlikely to talk until the canonical babbling increases.

Brown, Bendersky, and Chapman (1986) examined the utterances of infants born preterm. Thirty-three infants, whose corrected ages ranged from 9

months to 22 months, were assessed. Twenty-one of these infants had suffered intraventricular hemorrhage (IVH); the remaining 12 had not suffered any trauma. The results showed that both groups of preterm infants were delayed in all aspects of speech sound development (including the onset of babbling) when compared with developmental norms. The IVH children showed more serious delays than did the other preterm infants and the range of delay was much broader.

Somewhat different results were reported by Menyuk, Liebergott, and Schultz (1986). They examined data from a longitudinal study of two groups of infants, full-term and premature. Risk factors examined included low birth weight, respiratory distress, intraventricular hemorrhaging, and reported otitis media. Menyuk et al. attempted to determine whether the birth state of the infant was a good predictor of phonological or lexical production and whether early language behaviors predicted or correlated with later language behaviors. Their findings showed no significant differences between the two groups in any of the phonological or lexical measures used at any age. They concluded that there was no evidence to predict that a difficult beginning would lead to difficulties at a later age.

One of the predominant findings cited above was that the impaired infants started canonical babbling later than normal infants. This conclusion is clear with hearing impaired and infants with mental handicaps. It is less clear in infants who are biologically at risk (Menyuk et al., 1986) and infants who were premature. In

our society today a large percentage of infants live in environments that place them at risk for early language development. The effects of environmental risk have not been examined. No studies have looked at the early speech development of infants who are biologically sound but whose early life experiences—including maternal and family care, health care, opportunities for expression, and patterns of physical and social stimulation—are significantly limited. Information has been reported on the school age child, but little is known about the early development of these infants.

The purpose of this study was to determine the age of onset of canonical babbling in infants who are environmentally at risk. A group of 41 environmentally at-risk infants were included in this study to answer the following questions.

1. How many infants began to babble before 10 months, the upper end of the normal age range for the onset for canonical babbling?
2. Of those infants who did not begin to babble by the expected age, at what age did the onset of canonical babbling occur?

CHAPTER 2 METHOD

Subjects

Forty-one children, 25 boys and 16 girls, whose ages ranged from 7 months to 11 months were selected from day care centers, home day care programs, churches, health departments, and early educational centers in Florida, Georgia, and South Carolina. All subjects came from homes in which English is the predominant language. The following section describes characteristics of the subjects. These characteristics are summarized in Table 2-1, and a more detailed description of each subject is included in Appendix A.

Medical History

Parent interview, case history reports used by the sites, and medical records indicated that all subjects were full term babies with no history of acute or chronic disease. None of the children were reported to have organic or nonorganic failure to thrive, more than two episodes of otitis media, seizures, head injury, exposure to toxic agents, or iatrogenic disorder (problems caused by treatment, e.g., damage to the larynx from insertion of tubes).

Socio-Economic Background

All subjects came from the same socio-economic background. They all qualified as needing public assistance by federal standards for economic groups, even though some of them were not receiving any assistance.

Table 2-1. Brief description of each subject. Taped subjects are indicated by T; untaped subjects are indicated by U.

Subject Number	Age in Months	Sex	Race	T or U
1	7	M	B	T
2	8	F	B	T
3	7	F	W	T
4	8	M	B	T
5	8	M	B	T
6	7	F	B	T
7	7	M	B	T
8	8	M	B	T
9	8	F	B	T
10	8	M	B	T
11	8	F	W	T
12	8	M	B	T
13	8	F	B	T
14	10	M	B	T
15	10	M	B	T
16	10	F	B	T
17	10	F	B	T
18	10	F	B	T
19	10	M	B	T
20	10	M	B	T
21	10	M	B	T
22	11	M	B	T
23	11	F	B	T
24	11	M	B	T

Table 2-1—continued.

Subject Number	Age in Months	Sex	Race	T or U
25	11	M	B	T
26	8	M	B	U
27	8	M	B	U
28	8	M	B	U
29	9	M	B	U
30	9	M	B	U
31	9	M	W	U
32	10	M	B	U
33	10	M	W	U
34	10	F	B	U
35	10	M	B	U
36	10	F	B	U
37	11	F	B	U
38	11	M	B	U
39	11	F	B	U
40	11	F	B	U
41	11	M	B	U

Hearing Status

Several precautions were taken to exclude children with significant hearing impairment. During the initial interview, the parent was asked if the child had had any ear infections and if these had been diagnosed as otitis media. Those children with known hearing loss or more than two documented episodes of otitis media before 6 months of age were excluded. Studies have indicated that children with histories of otitis media often evidence phonological disorders that require later remediation (Paden, Novak, & Kuklinski, 1985). To insure that the infants could hear environmental sounds, the *Hearing Screening Guide for Professional Screening of Infants' Hearing* (Downs, 1979) and the *Surgeon General's Checklist for Parents* (Koop, 1986) were administered to screen the infants. Five infants failed two of four presentations of these screening tools, and a recheck was done to determine if the failure to respond was a transitory effect of attending to something else. Two of the infants continued to miss two of four presentations and were rechecked within one week. One child was referred for hearing examination based on screening results and was not included in the study.

Vision Status

The *Functional Vision Screening Test* (Langley, 1980) was used to screen visual activity of the infants. Twelve categories were scored using a "yes-no" checklist to verify eye movement, reaction, gaze, tracking, and eye preference. In addition, all subjects had normal vision as determined by their family physicians.

Normal Development

All subjects followed a normal developmental sequence in cognitive and motor skills. Public Law 99-457 requires that assessment of infants and toddlers cover five domain areas—cognition, language/communication, motor, psychosocial, and self help. *The Battelle Developmental Inventory* (Newborg, Stock, & Wnek, 1984) was used to assess these domains. Subjects were required to successfully complete two items at age level in all domain levels except communication.

Environmental Risk

All children met the standards for being at risk as stated by Public Law 99-457. These standards include

biologically sound infants for whom early life experiences including maternal and family care, health care, opportunities for expression of adaptive behaviors, and patterns of physical and social stimulation are sufficiently limiting to the extent that, without corrective intervention, they impart high probability for delayed development. (Tjossem, 1976, p.4)

One of the factors that may place an infant at-risk is the natural social interaction between infant and caregiver. To examine the type of interaction between the infant and caregiver the *Observation of Communicative Interaction* (Klein & Briggs, 1987) was administered. Interactions were rated as occurring "optimally," "often," or "rarely/never." Any items rated "rarely/never" placed the infant at risk for the particular interaction under observation.

To further determine if the social environment of the infant was at risk, the *Mothers' Assessment of Infants* (Field, Dempsey, Hallock, & Shuman, 1978) questionnaire was attempted to examine the caregiver characteristics of positive

affect, accurate knowledge of needs and behaviors, and good interactive matching with developmentally appropriate communication. The mothers were asked to circle one of the multiple choice responses that explain the infants behaviors. A summary of the mothers interpretation of the infant's behavior was than recorded. However, many of the mothers refused to complete this questionnaire. It was not always clear whether they were threatened by the nature of the questions, had difficulty completing them, or were simply fatigued.

To verify that the infant's environment was at risk the *Home Observation for Measurement of the Environment Inventory* (Caldwell & Bradley, 1984) was administered. Any score below the middle 50% was considered to indicate risk.

Procedure

Parental consent forms were distributed in all of the sites with flyers asking for participants and specifying the age range of 6 months through 10 months. Approximately 162 forms were distributed. Of the forms distributed, 114 were returned (a return rate of 70%). The returned forms were categorized by sites, and group and individual appointments were made through the directors of the centers to speak to parents of children who were within the age range and who used English as their predominant language. During the initial meeting with the parents, the purpose of the study and the evaluation procedures were explained. The parents were asked if their child was babbling, and in all of the meetings all parents said, "yes." A sample babbling tape was then played for the parents to verify if this was what they had heard from their babies. Most parents now stated,

"no." Those parents who still said, "yes," were asked when the babbling behavior began, and appointments were made to do the criterion testing at the sites and to verify that the infant was babbling.

Examiners

Three graduate students were extensively trained in administering all test items and the protocol for collecting speech samples from the infants. All three examiners and the author tested the infants to verify that they were following a normal development and visited day care centers and individual families to verify sound making productions and collect the speech samples.

Canonical Babbling Status

The parents of children who met all criteria stated above were contacted to review their child's evaluation results. The original consent form signed by each parent was redistributed and fully explained to be sure they understood the nature of the study (Appendix B). They were asked to read a copy of the letter silently along with the examiner. They were then informed that they could (verbally or in writing) withdraw from the study at any time.

Those children who were reported to be babbling already were visited by the examiner to verify their babbling behavior, and the date of onset that was reported by the parent was recorded. If the children were not babbling, the parent participated in the following informant training procedure.

Informant Training

Parents listened to a tape with 10 monosyllabic and 10 multiple syllable types. Each monosyllable was composed of one consonant followed by one vowel, e.g., [ba]. The multiple syllables ranged from two to five syllables with the same consonant and vowel pair repeated in the first two syllables. In strings of more than two syllables the vowel changed after the second syllable sequence, e.g., [bababibi]. The 10 monosyllables were played first, and the trainer explained to the parents that this was one of the types of speech sounds that the child will make. The key components of these productions, a consonant and a vowel, were explained. The parents were asked to repeat the sounds that they heard on the tape to verify that they could hear and interpret the sound productions. The same procedure was followed for the 10 multiple syllable productions. The key component for a multiple syllable was explained as two or more repetitions of the monosyllables together. A combination of monosyllables and multiple syllables was played for the parents. They were instructed to say "yes" each time they heard a monosyllable or multiple syllable. The researcher randomly chose either of the syllable types. All parents correctly identified 75% or more of the presented syllable types.

After training, the parents were asked to report to the day care site if they noticed any of the syllable-like sound productions. Day care workers participated in the training and assisted the researcher in recording samples. Weekly contact with day care workers and some individual parents was made by the researcher to

verify syllable-like sound productions or any speech-like sounds made by the infants.

Data Collection

Once syllable production was reported by parents or day care workers, home visits or day care site visits were made during the week of the report. One- to two-hour sessions were set up to record any sound making activity by the infants. If the infant made no sound activity, and the parent insisted that the infant had been making syllable productions, a cassette recorder was left with the parent to record any productions, and the researcher returned within two days. The researcher listened to the parent's taped samples immediately to determine if any canonical syllables had occurred. If no syllable-like sound making had occurred, a new tape was given to the parents and a return visit to that home was scheduled for the following week. If the researcher determined that the productions were canonical syllables, another attempt was made to record the infant. Twenty-five taped samples and 16 parental reports (confirmed but not taped) were obtained in this way.

Instrumentation

The researcher, two parents, and the graduate student examiners recorded all speech samples produced by the subjects. A Panasonic 612 stereo and a Marantz PMD 221 cassette deck and a Realistic PZM tabletop microphone were used to record all verbalizations. An attempt was made to place the microphone approximately one foot from the child. This did not remain constant during the

collection of the sample because of the rapid pace of the infants, which resulted in their sitting on or pulling the microphone closer to them. The infants were given several low noise age-appropriate toy(s) to manipulate. A parent or day care worker who might encourage vocalization was asked to engage the infant in a face-to-face interaction whenever possible. The recording sessions varied from 30 minutes to two hours. The number of recorded sessions varied from one to three as needed to obtain the minimum of 50 utterances.

Transcription

Prior to transcription of the data tapes, the researcher and supervisor used a sample tape of canonical babbling and discussed the transcription procedures. Auditorially, canonical syllables were identified by both listeners as those having the following properties:

- (1) at least one fully resonant nucleus (i.e., vowel of identifiable quality, high nasalized vowels being excluded by the resonance requirement); (2) one nonglottal margin (i.e., consonant other than glottal stop or glottal fricative), (3) duration of syllable and formant transitions that fit within the range of mature syllable production, and (4) normal phonation and pitch range. (Oller & Eilers, 1988, p. 443)

Using the prepared tape, the two listeners practiced listening for consonant and vowel combinations. They also listened for and identified coughs, sneezes, cries, squeals, grunts, laughter, quasiresonant productions, yells, whispers, and marginal syllables. Both listeners compared and discussed their transcriptions.

The two listeners then listened to and transcribed the audiotapes. The consensus transcription procedure developed by Shriberg, Kwiatkowski, and Hoffman (1984) was used to phonetically transcribe the utterances using standard

IPA symbols and variations suggested by Oller and Delgado (1990). The two independent listeners transcribed each utterance, and the two versions were then compared. In the case of a disagreement, the utterance in question was replayed a maximum of three times. After the replay, a consensus was reached on the sound production using the rules suggested by Shriberg et al. (1984).

Analysis of Data

The *Logical International Phonetics Programs (LIPP)* (Oller & Delgado, 1990) was used to encode the utterances from the transcripts. The *LIPP* is a software program that includes the International Phonetic Alphabet (IPA) and an existing set of sounds, symbols, and analysis rules that have been used in research with speech and speech-like vocalizations of infants and older children.

Each transcribed sample was divided into utterances. A single utterance was defined as a "breath-group," with not more than one second of internal silence (Oller, 1984). The *LIPP* counted the number of canonical syllables and divided this number by the total number of utterances in the sample. This calculation yielded a ratio of canonical syllables. A sample with a ratio of .2 or greater is considered to be within the canonical stage (Oller, 1984). The recommended minimum of 50 utterances was used in most instances to determine the ratio; however, seven subjects produced less than 50 utterances. Vegetative and/or presumed involuntary utterances (coughs, sneezes, cries, involuntary grunts, etc.) were excluded.

CHAPTER 3

RESULTS

The purpose of this study was to determine the age of onset of canonical babbling in infants who were environmentally at risk. A group of 41 environmentally at-risk infants were included in this study to answer two questions. Two types of subjects will be presented separately—those whose samples were taped ($N = 25$) and those whose samples were untaped ($N = 16$). Speech samples were collected and taped by an examiner when syllable sound activity was reported to have occurred by parents or day care workers. The untaped subjects were reported to have already started babbling when first encountered, and the researcher only verified that the babbling behavior was occurring and recorded the mother's report as to the age of onset of canonical babbling.

Question 1. How many infants will begin to babble before 10 months, the upper end of the normal age range for the onset of canonical babbling?

Figure 3-1 illustrates the number of children who began canonical babbling at each age between 6 and 12 months. Thirteen of the 25 taped subjects (53% of the taped subject population) began canonical babbling before 10 months of age. Six of the 16 untaped subjects (38% of the untaped population) were reported to have begun canonical babbling before 10 months.

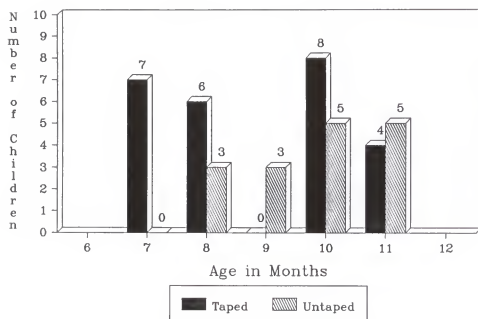


Figure 3-1. Number of taped and untaped subjects with onset of canonical babbling at each age.

Question 2. Of those infants who did not begin to babble before 10 months, at what age did the onset of canonical babbling occur?

The age of onset of canonical babbling and the number of subjects at each age can be seen on Figure 3-1. Eight taped subjects and 6 untaped subjects began babbling at 10 months; 4 taped subjects and 6 untaped subjects began babbling at 11 months. The ages of onset of canonical babbling ranged from 7 months to 11 months. Slightly more subjects began babbling late (at 10 months or later) than at the expected age. The mean age at onset of canonical babbling for the 25 taped subjects was 8.84. This figure is somewhat misleading, however, because the taped subjects clearly fell into two groups—those below the mean and those above the mean—with no subjects actually at the mean age of near 9 months. The mean age at onset for the 16 untaped subjects was 9.75.

Description of the Babbling

A canonical babbling ratio of .2 was used as the criterion for determining if canonical babbling had occurred (Oller, 1984). The canonical babbling ratio of all taped subjects was above .2. The actual canonical babbling ratio of each taped subject can be seen in Table 3-1. The mean ratio for the 25 taped subjects was 1.052 (well over the .2 required) with a standard deviation of .477. The range of these ratios was from .485 to 2.140.

The total number of syllables produced by the taped subjects ranged from 30 to 143 (Table 3-2) with a mean of 86.40 and a standard deviation was 28.955.

Table 3-1. Canonical and marginal babbling ratio of each taped subject.

Subject	Age in Months	Canonical Babbling Ratio	Marginal Babbling Ratio
1	7	0.960	0.260
2	7	0.560	0.040
3	7	0.650	0.000
4	7	0.485	0.000
9	7	1.360	0.000
4	7	0.960	0.000
7	7	0.640	0.500
8	8	1.360	0.140
9	8	1.360	0.060
10	8	0.640	0.514
11	8	0.526	0.000
12	8	0.640	0.140
13	8	1.840	0.000
13	10	0.920	0.220
15	10	2.140	0.000
18	10	1.500	0.220
17	10	1.600	0.000
18	10	1.580	0.420
15	11	0.960	0.000
20	10	0.640	0.000
21	10	1.200	0.020
22	11	1.366	0.024
23	11	1.000	0.036
24	11	1.740	0.000
25	11	0.588	0.176

Table 3-2. Numbers of utterances, syllables, quasivowels, full vowels, canonical syllables, and marginal syllables produced by each taped subject.

Subject	Age in Months	Number of					
		Utt	Syl	Q Vow	Full Vow	Can Syl	Mar Syl
1	7	50	105	6	86	49	13
2	7	50	69	8	59	28	2
3	7	20	30	3	27	13	0
4	7	33	65	6	65	16	0
5	7	50	95	6	85	67	9
4	7	50	90	25	65	49	0
7	7	50	111	9	97	92	25
8	6	50	105	6	101	67	4
4	7	50	117	2	112	67	3
16	7	35	77	11	48	17	18
13	7	19	32	0	31	10	0
12	8	50	77	3	67	32	7
13	8	50	120	6	111	92	2
14	10	50	88	3	74	46	11
15	10	50	121	2	111	107	0
16	10	50	91	16	74	50	1
17	10	50	97	0	97	50	0
19	10	50	143	1	121	79	21
19	10	50	98	47	51	33	0
20	10	50	80	0	73	33	7
21	10	50	78	1	76	50	1
22	11	41	80	5	74	50	1
23	11	28	40	2	37	28	1
24	11	50	110	1	106	87	0
25	11	17	41	2	36	10	3

The average number of syllables per utterance was 2.01, indicating that most of the syllables were not monosyllables. The number of canonical syllables used by the taped subjects ranged from 10 to 107 with a mean of 48.40 and a standard deviation of 27.483.

Each syllable contained one of four types of syllable nucleus: full vowel, marginal vowel, quasivowel, or syllabic consonant. The numbers of occurrence of the three types of vowels are included in Table 3-2. Quasivowels are partially resonant "because the relatively closed vocal posture involved in production of the sound fails to take advantage of the substantial potential of the vocal tract to serve as a resonator" (Oller et al., 1985, pp. 52-53). The number of quasivowels ranged from 0 to 47 with a mean of 6.12. Six subjects produced no syllables that were perceived in this way, whereas some subjects used quasivowels quite frequently. Marginal vowels are defined as vowels that have the characteristics of full vowels without the perceptually recognized durations of formant transitions (Oller, 1986). Although the definition appears vague, Oller and his associates have demonstrated that they can be reliably recognized by listeners (Oller & Eilers, 1988). Any syllable containing a marginal vowel is by definition a marginal syllable. In the taped samples the number of marginal syllables ranged from 0 to 25 with a mean of 5.16. These were typically recognized by the transcribers as being longer in duration than speech vowels or as having unusual slides into and out of other syllables or silences.

The number of full vowels in the taped samples ranged from 27 to 121 with a mean of 74.88. Table 3-3 includes the inventory of vowels perceived by the listeners for each taped subject. Note that this table does not indicate the frequency with which each vowel was used. In addition, vowels that were clearly full vowels but whose quality was not distinct were transcribed merely as Vowel (V). The number of different vowels used by these subjects ranged from 5 to 11. The relative frequency of each commonly used vowel can be seen in Figure 3-2. Clearly, the most common vowel was /æ/, 40% of the vowels used. Figure 3-3 indicates that 59% of the vowels were front vowels, 19% were central vowels, and 11% were back vowels.

All taped subjects used at least one or more recognizable consonants in their speech samples. Table 3-4 includes the inventory of consonants perceived by the listeners for each taped subject. As with the vowels reported above, this table does not indicate the frequency with which each consonant was used. In addition, sounds that were clearly produced by consonant-like constriction or obstruction but were not distinct were transcribed merely as Consonant (C). Figure 3-4 indicates graphically the most commonly used consonants. The most frequent consonants were /d/ and /ʔ/, 20% and 18% respectively. In Figure 3-5 the consonants have been categorized by manner of articulation, indicating that approximately half of the sample was made up of stops. When the consonants were examined by place of articulation (Figure 3-6), it was seen that glottals were only

Table 3-3. Inventory of identifiable vowels used by each taped subject.

S	Front Vowels	Central Vowels	Back Vowels	Diphthongs
1	i, e, ε, æ	ʌ, ə	u, ɑ	
2	i, æ	ʌ, ə	u	əu
3	i, e, æ	ʌ	u	
4	i, i, æ	ʌ, ə	u	
5	i, i, e, e, æ	ʌ, ə	u, ɑ	
6	i, e, æ	ʌ, ə	u, ɑ	aɪ
7	i, e, e, æ	ʌ, ə	u, u	
8	i, i, e, æ	ʌ, ə	u, o, ɑ	
9	i, i, e, e, æ	ʌ, ə	u, u	
10	i, e, e, æ	ʌ, ə	u	
11	i, e, e, æ	ʌ, ə	ɑ	aɪ
12	i, æ	ʌ, ə	u, o, ɔ, ɑ	
13	i, i, e, æ	ʌ, ə	u, u, ɑ	aɪ
14	i, e, e, æ	ʌ, ə	o, ɑ	
15	i, e, e, æ	ʌ, ə	o, ɑ	
16	i, i, e, e, æ	ʌ, ə	u, u, o, ɑ	
17	i, i, e, e, æ	ʌ, ə	u, u, ɑ	aɪ
18	i, i, æ	ʌ, ə	u, ɔ, ɑ	aɪ
19	i, i, e, æ	ʌ, ə	u, u, ɑ	
20	e, æ	ʌ, ə	u	
21	i, i, e, æ	ʌ, ə		
22	i, e, e, æ		u, u, o, ɔ, ɑ	aɪ
23	i, æ	ʌ, ə	u, ɑ	aɪ
24	i, i, e, e, æ	ʌ, ə	u, u, o	
25	i, i, e, æ	ʌ, ə	u, ɑ	

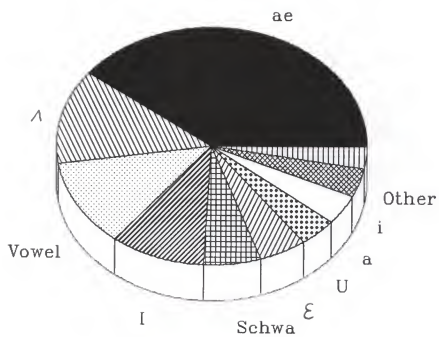


Figure 3-2. Percentage of occurrence of each vowel used by taped subjects.

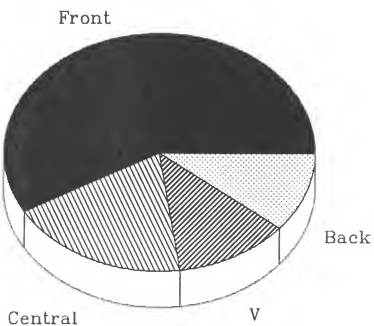


Figure 3-3. Percentage of occurrence of each vowel type used by taped subjects.

Table 3-4. Inventory of identifiable consonants used by each taped subject.

Sub	Stops	Fricatives/Affricates	Nasals	Liq/Glides
1	g, ?	h	n	w, j
2	b, p, d, g, ?	h		w
3	?	h	m	j
6	?	h		w, j
5	b, d, t, g, k, ?	v, h		w, j
6	p, d, g, k, ?	h	m, n	w, l, j
9	g, ?	h	n, ŋ	w, j
9	p, d, t, g, ?	h	m	j
9	b, d, t, g, ?	β, h	m, n	w, j
10	b, d, ?	h	n	j
14	b, d, ?	h		j
12	b, d, g, ?	h	m	w
13	b, p, d, g, k, ?	h	m, n	w, l, j
14	d, t, k, ?	h		w, l, j
15	b, p, d, t, g, k, ?	h	m	w, j
10	b, d, g, k, ?	θ, x, h	n,	w, l, j
17	b, d, t, g, ?	β, ž, h, ĵ	m	w, l, j
18	b, d, g, k, ?	β, h	m, n	j
10	g, k, ?	h	m, n, ŋ	w
20	b, d, t, g, k, ?	x, h		w, j
21	d, t, g, k, ?	h		w, j
22	b, d, t, k, h	h	m	w
23	b, d, g, k, ?	h	m	w
24	b, d, t, g, k, ?	h	m, n	w, j
25	d, g, ?	h		j

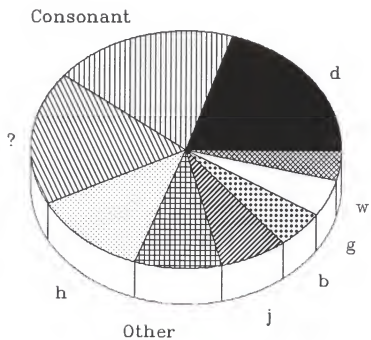


Figure 3-4. Percentage of occurrence of each consonant used by taped subjects.

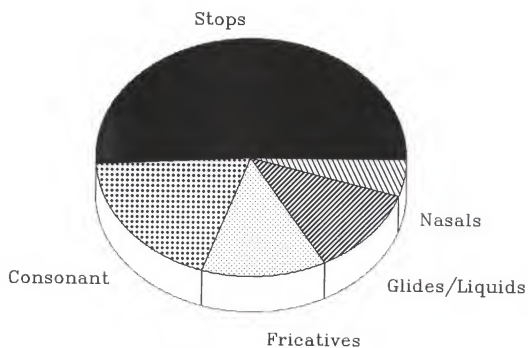


Figure 3-5. Percentage of occurrence of each consonant manner used by taped subjects.

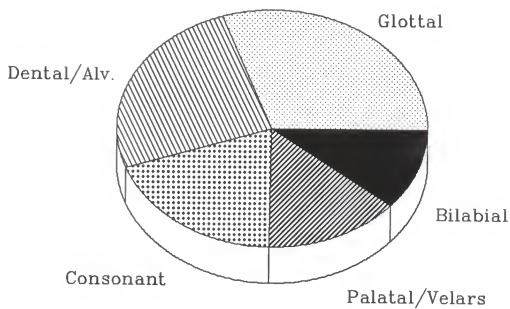


Figure 3-6. Percentage of occurrence of each consonant place used by taped subjects.

slightly more common (30%) than the dental/alveolars (25%). It should be noted that for purposes of determining canonical syllables, syllables with glottal consonants at their margins are not considered to be canonical unless there is a "true consonant" (place other than glottal) at the other margin (Oller & Delgado, 1990). For example, /hu/ is not canonical, but /hubu/ would include two canonical syllables.

Reliability

All tapes were transcribed by two trained observers, both of whom were familiar with the transcription of children's speech. One of the transcribers had experience with transcriptions of disordered speech and of other languages, whereas the other transcriber was familiar with the speech of families such as those included. One transcriber was involved with the recording of the samples and coded some of the mouth movements of the infants, such as lip closure, tongue position, and place of articulation during sound making. The relatively speech-like utterances were narrowly transcribed using a modified version of the International Phonetic Alphabet (IPA), with modifications developed for transcription of infant speech (Oller & Delgado, 1990). The LIPP program (Oller & Delgado, 1990) used to input the transcriptions has been widely used for input and analysis of infant speech. The transcribers worked independently and then attempted to resolve differences. They were in agreement point to point on approximately 80% of the utterances on the vocalic and consonantal parameters

of the infant vocalizations. The agreement level on reduplication sequences was higher, surpassing the 90% level.

CHAPTER 4

DISCUSSION AND CONCLUSIONS

The purpose of the present study was to examine the age of onset of canonical babbling in infants who were environmentally at risk. Forty-one infants in two groups, taped subjects and untaped subjects, were followed to determine the number of children who began canonical babbling at each age between 6 and 12 months. About half of the 25 taped subjects began canonical babbling before 10 months of age, whereas the other half began canonical babbling after 10 months. About one-third of the 16 untaped subject were reported to have begun canonical babbling before 10 months and about two-thirds after 10 months.

Comparison with Literature

Both Stark (1980) and Oller (1980) agreed that the onset of canonical babbling is clear and salient even to the unsophisticated listener. Infants seem to say "bababa" or "dadada," and parents sometimes mistakenly think the baby has actually learned to communicate with words. The infants in the current study were clearly producing this type of utterance. The following examples illustrate utterances produced by two of the subjects:

Subject 1, [wæwæwæwæ], [dædædæ], and [hʌhʌhʌ];

Subject 8, [nænænæ], [gʌgʌgʌ], and [dididi].

The listeners had little difficulty with the transcription after the initial orientation. Although not all consonants and vowels could be put into clearly defined adult phoneme categories, there was little disagreement as to whether a sound was a C or V and whether these sounds composed a syllable.

Oller (1980) and Stark (1980) also agreed that canonical or reduplicated babbling, characterized by a series of consonant-vowel (CV) syllables with each syllable perceived as being similar to every other, begins between the ages of 6 and 10 months. It resembles speech much more closely in its timing than the vocal behaviors found in any previous stage of vocal development. Some instances of quasiresonant nuclei—probably less than 10% (Oller, 1980)—and marginal vowels continue even after the onset of canonical babbling, however. This was seen clearly in the following subjects:

Subject 14, [dQdQ] and [QCæ];

Subject 16, [Qgugaga] and [Qŋæ].

Investigators have concluded that the onset of canonical babbling is delayed in several populations. Oller et al. (1985) and Oller and Eilers (1988) have shown that deaf infants reach the onset of canonical babbling much later than hearing infants. Smith and Oller (1981) found a similar delay in the onset of canonical babbling in Down syndrome children. Infants born preterm also appear to be delayed in the onset of canonical babbling (Brown et al., 1986), although the delay has not been consistently demonstrated in all studies of this population (Menyuk et al., 1986). The infants in the current study were clearly delayed when

compared with the normally developing child. Well over half of them began to babble after the expected age of 10 months.

One reason for undertaking this study of infants who were environmentally at risk was that researchers have agreed that the later functioning of the individual child is determined both by the child's constitution and by the specific characteristics of the environment to which the child is exposed. The overall predictive power of the environmental variables alone has been shown to be considerably stronger than that of constitutional variables (Broman et al., 1975; Caputo et al., 1981; Sameroff & Chandler, 1975; Sameroff, 1981). In fact, many of the studies cited agreed that environmental variables are likely to constitute by far the strongest influence on development from the early childhood years.

The Polk County, Oregon, program (Johnson, 1989) addressed the need for monitoring the development of infants and young children designated as at-risk, either biologically or environmentally. In Polk County the environmental factors that created the greatest need for monitoring infants included: a high rate of poverty, single parenthood, teen parents, suspect caregiver interaction, parenting abilities, and unemployment. Families of the subjects in the current study were found to have many of the same designated risk factors. Fifty-one percent of the mothers were single parents, 62% were suspected to have a lack of caregiver interaction, 77% were in parenting classes at their center and were suspected to need improvement in parenting skills, and 80% of the families had a fluctuating employment status.

Because of the current national statistics that indicate that one-quarter of all babies born in the United States are born into poverty and one-fifth are born to single parents, and because of the increasing number of unmarried teenagers and women in the labor force (Walkins & Melnick, 1985), there is a need for careful monitoring of speech and language development in various environments. A large percentage of the infants in this study spend at least five days a week in out-of-home care by non-relatives. In the present day care facilities for families, 19% of the day care providers have an eighth grade education or less and know little about stimulating speech and language development of children (Walkins & Melnick, 1985).

In this study the range of ages for canonical babbling was from 7 to 11 months. When looking at speech samples of these children and noting that the normal onset of canonical babbling reported by researchers ranged from 6 to 10 months (Oller, 1980; Stark, 1980), one sees a similar, but slightly older, range and a tendency for the infants to fall at the upper end of this range. The possibility that the older children in this study might have really begun babbling before observations and that they might, in fact, be at a later stage of prespeech activity, was explored. If this had been the case, it was assumed that their canonical babbling ratios would have been higher than those of the children who were found to begin babbling earlier. To confirm this a Pearson Product Moment correlation coefficient was used to determine the strength of the relationship between age in months and the canonical babbling ratio. It was found that there

was little relationship between these two measures— $r = .33$ —indicating that the canonical babbling ratio was only very weakly related to age. The older subjects were not likely to have higher ratios than the younger subjects.

The actual samples of the infants in this study were examined to compare them with those seen by other researchers. If they were more varied or included a higher level of vocalization than those described in the literature as being typical of the onset of babbling, it might be suspected that they had passed this point prior to observation. In fact, these infants from 7 to 11 months of age produced samples of vocalization that were very similar to those described for children from 6 to 9 months of age. These characteristics included a predominance of full vowel nuclei with approximately 10% of syllables still containing quasivowels, a frequent use of front and back vowel, and the use of strings of similar CV(s). Previous research would predict that a normal 11-month-old would use complex babbling strings with varied consonants and full vowels for almost all syllables (variegated babbling). This was not the case for even the oldest children in this study (11 months). Their sample had the timing, intonation, vowel nuclei, more frequent use of quasivowels, and the frequent use of the glottal stop and [h] expected in a normal child within the range of 6 to 10 months. These infants were capable of considerable variation in vocalization and various sound types, however. The consonants were identified as stops, fricatives, nasals, and glides. The vowels used were primarily the front and central vowels with some back vowels also included.

Implications

Some of the infants in this study were clearly babbling at the normal age, whereas some of them were delayed. It was interesting that the samples of the taped infants appeared to fall into two age groups with little or no overlap between the groups. Some children babbled within the age range in which they would have been expected to start babbling, and some children did not. It is possible that there were, in fact, two different types of infants included, separated by some unknown variable that might have predicted the late onset of babbling in over half of them. If this factor were lacking in the younger group, it would be important to isolate it to allow prediction in other populations. The use of parent and caregiver reports to cue the examiner to come and observe the babbling might be suspected as a source of variation. Possibly some parents and caregivers are better judges and make more accurate listeners. Oller (1980), however, reported that an evaluation of parental opinions about babbling behavior was relatively accurate even though the names of the babbling behaviors would differ. In fact, most of the reported studies of the onset of babbling have relied on such reports. Subjects whose parents indicated that they were not babbling at the initial phase of the study were followed by the examiner to confirm their mothers' opinions, and in no case was babbling actually observed by the examiner. It was also possible to reliably confirm the other case, in which mothers might have reported babbling when none was occurring. If babbling could not be confirmed by the examiner, it was not credited.

Two other factors were also explored to determine if the younger groups appeared to be different than the older group. Because one risk factor cited by other research is the number of persons in the home, a Pearson's Product Moment correlation coefficient was computed to examine the relationship between age and number in the home. The r of $-.04$ indicates no relationship between these two measures at all. Clearly the number of persons in the home did not distinguish between the older and younger subjects. The percentage of single mothers within each group was computed and was found to be 42% in the younger group as compared with 77% in the older group. This factor might have been responsible for some of the difference in age of canonical babbling of the older group of children.

If, as indicated by these results, some at-risk infants (possibly those with single parents) do begin babbling later than would be expected in normal children, and if, as indicated in the literature, such a delay in babbling has an effect on later speech and language development, identification and intervention with this group is imperative. Those infants who are clearly at risk on one or more factors should be enrolled in programs including early stimulation of vocal play. Language stimulation training for day care workers and for the parents of such infants should also be included. Several of the parents in this study were already enrolled in parenting classes. However, scores on two of the risk measures indicated showed needs in this area. The *Observation of Communicative Interaction—OCI* (Klein & Briggs, 1986) results (Appendix A) indicated that

about one-quarter of the parents were rated as Sometimes on one or more of the three questions pertaining to encouraging communication:

7. Encourages "conversation,"
9. Modifies interaction in response to negative cues from infant, and
10. Uses communication to teach language and concepts.

In addition, 15% scored in the lower 25% on the *Home Inventory (Birth to 3)* subscale of maternal involvement with child.

Strengths and Weaknesses of the Study

Several factors were considered to be strengths of this study. Although multiple risk factors were considered, there were families in all of the risk categories rather than in just one or two. The examiners were familiar with the kinds of programs in which the infants were enrolled, and had the opportunity to follow the taped subjects very closely, taping several sessions with the babies when needed. Very good tape recorders and microphones were used, yielding samples that were generally very clear and easy to transcribe. However, the sensitivity of the microphones sometimes caused difficulty because other extraneous noises were also picked up. The same protocol was closely followed for all taped subjects to control for factors such as time between identification and taping.

After listening to the canonical babbling tape the mothers really started to listen to their babies and reported almost daily to the day care workers what was happening. The day care workers also developed a keen ear for babbling.

Some weaknesses were also identified. The testing environments were in home and day care centers, and sometimes the tapes were noisy. The low noise toys sometimes created more noise than expected for some babies, depending on their level of activity. Families, including other children, sometimes talked or competed for attention with the babies during testing, and mothers sometimes tried to force babies to babble. On some occasions, the examiner talked while the infant was babbling which made some portions of the transcription difficult to transcribe.

At risk families often relocate, and many of the babies dropped out of the study before tapings could be done. Families implied cooperation but were not always cooperative. With the child abuse issues being highly publicized, many families would not let a stranger test and follow their babies. And finally, because an African American woman was doing the study many Caucasian families would not participate.

Need for Further Research

There is a need for further research with larger numbers of subjects, especially among the 11-month-olds. More taped sample would confirm that canonical babbling really begins at this age in children such as these. This population is a fast growing population and needs the early stimulation. Further studies might validate the effect of such stimulation on the age of onset of babbling. This type of research would help decide what areas of concentration would be needed in such early stimulation. Assessment teams are now more

transdisciplinary, and speech-language pathologist working with the younger population often is asked to determine whether or not an infant is at risk. Further studies such as this, will help to pinpoint some of the possible factors to consider in determining the communication risk of infants. For example, the age of onset of reduplicated babbling may be an indicator for word production.

Conclusions

In summary, the results of this study indicate include several conclusions about the onset of canonical babbling.

1. The range of age at onset of canonical babbling for environmentally at-risk infants range was higher than the normal range.
2. More than half of the infants (54%) began to babble at 10 months or later, even though normal infants typically begin before 10 months.
3. Almost half of the infants (46%), however, were with the normal range of onset.
4. The sounds produced by these children follow the patterns reported for children who babble in the normal range.
5. There appear to be more single mothers among the group of children who begin to babble late than among the group who babble early.

APPENDIX A
SUBJECT PROFILES

Subject # 1, CA: 7 months, Sex: M
 Mother: 26, 2 years of college, married
 Father: 29, high school
 CA of Brothers: 3
 CA of Sisters: none
 People in Home: 4
 Site: Day Care Center
 Number of Ear Infections: none

Test Name: *Observation of Communicative Interaction (OCI)*

<u>Question</u>	<u>Scores</u>
1. Appropriate tactile/kinesthetic stimulation	Optimally
2. Pleasure during mother/infant interaction	Optimally
3. Responds to child's distress	Optimally
4. Positions self to allow eye contact	Often
5. Smiles contingently at infant	Optimally
6. Varies prosodic features	Often
7. Encourages "conversation"	Sometimes
8. Responds contingently to infant	Often
9. Modifies interaction in response to negative cues from infant	Sometimes
10. Uses communication to teach language & concepts	Often

Test Name: *Home Inventory (Birth to 3)*

<u>Subscales</u>	<u>Percentile</u>
I. Emotional & Verbal Responsivity of Mother	Upper 10%
II. Avoidance of Restriction & Punishment	Lower 25%
III. Organization of Physical & Temporal Environment	Middle 50%
IV. Provision of Appropriate Play Materials	Middle 50%
V. Maternal Involvement with Child	Lower 25%
VI. Opportunities for Variety in Daily Stimulation	Middle 50%

Test Name: *Battelle Developmental Inventory*

<u>Domain</u>	<u>Raw Score</u>	<u>Age Equivalent in Months</u>
Personal-Social	26	7
Adaptive	24	9
Motor	34	8
Communication	14	6
Cognitive	16	8
BDI Total Score	114	8

Subject # 2, CA: 7 months, Sex: F
 Mother: 30, 2 years of college, married
 Father: 33, 1 year of college
 CA of Brothers: none
 CA of Sisters: 3
 People in Home: 4
 Site: Home day care program
 Number of Ear Infections: none

 Test Name: *Observation of Communicative Interaction (OCI)*

<u>Question</u>	<u>Scores</u>
1. Appropriate tactile/kinesthetic stimulation	Optimally
2. Pleasure during mother/infant interaction	Often
3. Responds to child's distress	Often
4. Positions self to allow eye contact	Often
5. Smiles contingently at infant	Optimally
6. Varies prosodic features	Often
7. Encourages "conversation"	Often
8. Responds contingently to infant	Often
9. Modifies interaction in response to negative cues from infant	Sometimes
10. Uses communication to teach language & concepts	Often

Test Name: *Home Inventory (Birth to 3)*

<u>Subscales</u>	<u>Percentile</u>
I. Emotional & Verbal Responsivity of Mother	Upper 25%
II. Avoidance of Restriction & Punishment	Lower 25%
III. Organization of Physical & Temporal Environment	Middle 50%
IV. Provision of Appropriate Play Materials	Middle 50%
V. Maternal Involvement with Child	Lower 25%
VI. Opportunities for Variety in Daily Stimulation	Middle 50%

Test Name: *Battelle Developmental Inventory*

<u>Domain</u>	<u>Raw Score</u>	<u>Age Equivalent</u>
Personal-Social	25	6
Adaptive	24	9
Motor	34	8
Communication	14	6
Cognitive	16	8
BDI Total Score	113	8

Subject # 3, CA: 7 months, Sex: F
 Mother: 28, high school education, married
 Father: 26, high school education
 CA of Brothers: none
 CA of Sisters: none
 People in Home: 3
 Site: Day care
 Number of Ear Infections: none

Test Name: *Observation of Communicative Interaction (OCI)*

<u>Question</u>	<u>Scores</u>
1. Appropriate tactile/kinesthetic stimulation	Optimally
2. Pleasure during mother/infant interaction	Optimally
3. Responds to child's distress	Often
4. Positions self to allow eye contact	Optimally
5. Smiles contingently at infant	Often
6. Varies prosodic features	Often
7. Encourages "conversation"	Sometimes
8. Responds contingently to infant	Often
9. Modifies interaction in response to negative cues from infant	Sometimes
10. Uses communication to teach language & concepts	Sometimes

Test Name: *Home Inventory (Birth to 3)*

<u>Subscales</u>	<u>Percentile</u>
I. Emotional & Verbal Responsivity of Mother	Upper 25%
II. Avoidance of Restriction & Punishment	Middle 50%
III. Organization of Physical & Temporal Environment	Middle 50%
IV. Provision of Appropriate Play Materials	Middle 50%
V. Maternal Involvement with Child	Middle 50
VI. Opportunities for Variety in Daily Stimulation	Lower 25%

Test Name: *Battelle Developmental Inventory*

<u>Domain</u>	<u>Raw Score</u>	<u>Age Equivalent</u>
Personal-Social	26	7
Adaptive	24	9
Motor	33	8
Communication	14	6
Cognitive	16	8
BDI Total Score	113	8

Subject # 4, CA: 7 months, Sex: M
 Mother: 23, high school education, single
 Father: 36, high school education
 CA of Brothers: 4
 CA of Sisters: 2
 People in Home: 4
 Site: Family home
 Number of Ear Infections: none

Test Name: *Observation of Communicative Interaction (OCI)*

<u>Question</u>	<u>Scores</u>
1. Appropriate tactile/kinesthetic stimulation	Optimally
2. Pleasure during mother/infant interaction	Often
3. Responds to child's distress	Sometimes
4. Positions self to allow eye contact	Often
5. Smiles contingently at infant	Often
6. Varies prosodic features	Often
7. Encourages "conversation"	Often
8. Responds contingently to infant	Often
9. Modifies interaction in response to negative cues from infant	Often
10. Uses communication to teach language & concepts	Sometimes

Test Name: *Home Inventory (Birth to 3)*

<u>Subscales</u>	<u>Percentile</u>
I. Emotional & Verbal Responsivity of Mother	Upper 10%
II. Avoidance of Restriction & Punishment	Lower 25%
III. Organization of Physical & Temporal Environment	Middle 50%
IV. Provision of Appropriate Play Materials	Middle 50%
V. Maternal Involvement with Child	Middle 50%
VI. Opportunities for Variety in Daily Stimulation	Middle 50%

Test Name: *Battelle Developmental Inventory*

<u>Domain</u>	<u>Raw Score</u>	<u>Age Equivalent</u>
Personal-Social	28	8
Adaptive	19	7
Motor	35	9
Communication	12	5
Cognitive	14	7
BDI Total Score	108	7

Subject # 5, CA: 7 months, Sex: M
 Mother: 21, 9th Grade, single
 Father: 19, education unknown
 CA of Brothers: none
 CA of Sisters: none
 People in Home: 3
 Site: Family home
 Number of Ear Infections: none

Test Name: *Observation of Communicative Interaction (OCI)*

<u>Question</u>	<u>Scores</u>
1. Appropriate tactile/kinesthetic stimulation	Often
2. Pleasure during mother/infant interaction	Often
3. Responds to child's distress	Sometimes
4. Positions self to allow eye contact	Often
5. Smiles contingently at infant	Sometimes
6. Varies prosodic features	Sometimes
7. Encourages "conversation"	Often
8. Responds contingently to infant	Often
9. Modifies interaction in response to negative cues from infant	Sometimes
10. Uses communication to teach language & concepts	Sometimes

Test Name: *Home Inventory (Birth to 3)*

<u>Subscales</u>	<u>Percentile</u>
I. Emotional & Verbal Responsivity of Mother	Middle 50%
II. Avoidance of Restriction & Punishment	Lower 10%
III. Organization of Physical & Temporal Environment	Middle 50%
IV. Provision of Appropriate Play Materials	Lower 10%
V. Maternal Involvement with Child	Lower 25%
VI. Opportunities for Variety in Daily Stimulation	Middle 50%

Test Name: *Battelle Developmental Inventory*

<u>Domain</u>	<u>Raw Score</u>	<u>Age Equivalent</u>
Personal-Social	25	6
Adaptive	18	6
Motor	35	9
Communication	12	5
Cognitive	16	8
BDI Total Score	106	7

Subject # 6, CA: 7 months, Sex: F
 Mother: 19, high school education, single
 Father: 19, high school education
 CA of Brothers: none
 CA of Sisters: none
 People in Home: 6
 Site: Family home
 Number of Ear Infections: none

 Test Name: *Observation of Communicative Interaction (OCI)*

<u>Question</u>	<u>Scores</u>
1. Appropriate tactile/kinesthetic stimulation	Often
2. Pleasure during mother/infant interaction	Often
3. Responds to child's distress	Often
4. Positions self to allow eye contact	Often
5. Smiles contingently at infant	Often
6. Varies prosodic features	Sometimes
7. Encourages "conversation"	Often
8. Responds contingently to infant	Often
9. Modifies interaction in response to negative cues from infant	Sometimes
10. Uses communication to teach language & concepts	Often

Test Name: *Home Inventory (Birth to 3)*

<u>Subscales</u>	<u>Percentile</u>
I. Emotional & Verbal Responsivity of Mother	Upper 10%
II. Avoidance of Restriction & Punishment	Middle 50%
III. Organization of Physical & Temporal Environment	Middle 50%
IV. Provision of Appropriate Play Materials	Lower 25%
V. Maternal Involvement with Child	Lower 25%
VI. Opportunities for Variety in Daily Stimulation	Middle 50%

Test Name: *Battelle Developmental Inventory*

<u>Domain</u>	<u>Raw Score</u>	<u>Age Equivalent</u>
Personal-Social	24	6
Adaptive	20	7
Motor	29	7
Communication	14	6
Cognitive	14	7
BDI Total Score	101	7

Subject # 7, CA: 7 months, Sex: M
 Mother: 25, some college, married
 Father: 26, some college
 CA of Brothers: 1, 2
 CA of Sisters: none
 People in Home: 4
 Site: Day care center
 Number of Ear Infections: 1

Test Name: *Observation of Communicative Interaction (OCI)*

<u>Question</u>	<u>Scores</u>
1. Appropriate tactile/kinesthetic stimulation	Optimally
2. Pleasure during mother/infant interaction	Often
3. Responds to child's distress	Often
4. Positions self to allow eye contact	Often
5. Smiles contingently at infant	Often
6. Varies prosodic features	Often
7. Encourages "conversation"	Sometimes
8. Responds contingently to infant	Often
9. Modifies interaction in response to negative cues from infant	Often
10. Uses communication to teach language & concepts	Often

Test Name: *Home Inventory (Birth to 3)*

<u>Subscales</u>	<u>Percentile</u>
I. Emotional & Verbal Responsivity of Mother	Middle 50%
II. Avoidance of Restriction & Punishment	Middle 50%
III. Organization of Physical & Temporal Environment	Middle 50%
IV. Provision of Appropriate Play Materials	Middle 50%
V. Maternal Involvement with Child	Lower 25%
VI. Opportunities for Variety in Daily Stimulation	Lower 10%

Test Name: *Battelle Developmental Inventory*

<u>Domain</u>	<u>Raw Score</u>	<u>Age Equivalent</u>
Personal-Social	25	6
Adaptive	19	7
Motor	26	6
Communication	14	6
Cognitive	11	6
BDI Total Score	95	6

Subject # 8, CA: 8 months, Sex: M
 Mother: 41, high school education, married
 Father: 41, high school education
 CA of Brothers: 13
 CA of Sisters: 12, 5
 People in Home: 6
 Site: Church day care
 Number of Ear Infections: none

 Test Name: *Observation of Communicative Interaction (OCI)*

<u>Question</u>	<u>Scores</u>
1. Appropriate tactile/kinesthetic stimulation	Optimally
2. Pleasure during mother/infant interaction	Often
3. Responds to child's distress	Often
4. Positions self to allow eye contact	Often
5. Smiles contingently at infant	Often
6. Varies prosodic features	Often
7. Encourages "conversation"	Often
8. Responds contingently to infant	Often
9. Modifies interaction in response to negative cues from infant	Optimally
10. Uses communication to teach language & concepts	Often

Test Name: *Home Inventory (Birth to 3)*

<u>Subscales</u>	<u>Percentile</u>
I. Emotional & Verbal Responsivity of Mother	Middle 50%
II. Avoidance of Restriction & Punishment	Middle 50%
III. Organization of Physical & Temporal Environment	Middle 50%
IV. Provision of Appropriate Play Materials	Lower 25%
V. Maternal Involvement with Child	Middle 50%
VI. Opportunities for Variety in Daily Stimulation	Middle 50%

Test Name: *Battelle Developmental Inventory*

<u>Domain</u>	<u>Raw Score</u>	<u>Age Equivalent</u>
Personal-Social	25	6
Adaptive	24	9
Motor	41	10
Communication	17	8
Cognitive	16	8
BDI Total Score	123	9

Subject # 9, CA: 8 months, Sex: F
 Mother: 32, college, married
 Father: 41, technical School
 CA of Brothers: 3 (only talking in single words)
 CA of Sisters: none
 People in Home: 4
 Site: Day care
 Number of Ear Infections: none

Test Name: *Observation of Communicative Interaction (OCI)*

<u>Question</u>	<u>Scores</u>
1. Appropriate tactile/kinesthetic stimulation	Optimally
2. Pleasure during mother/infant interaction	Optimally
3. Responds to child's distress	Optimally
4. Positions self to allow eye contact	Optimally
5. Smiles contingently at infant	Often
6. Varies prosodic features	Often
7. Encourages "conversation"	Often
8. Responds contingently to infant	Often
9. Modifies interaction in response to negative cues from infant	Optimally
10. Uses communication to teach language & concepts	Optimally

Test Name: *Home Inventory (Birth to 3)*

<u>Subscales</u>	<u>Percentile</u>
I. Emotional & Verbal Responsivity of Mother	Upper 25%
II. Avoidance of Restriction & Punishment	Middle 50%
III. Organization of Physical & Temporal Environment	Middle 50%
IV. Provision of Appropriate Play Materials	Lower 25%
V. Maternal Involvement with Child	Middle 50%
VI. Opportunities for Variety in Daily Stimulation	Middle 50%

Test Name: *Battelle Developmental Inventory*

<u>Domain</u>	<u>Raw Score</u>	<u>Age Equivalent</u>
Personal-Social	26	7
Adaptive	20	7
Motor	46	11
Communication	16	7
Cognitive	18	10
BDI Total Score	126	9

Subject # 10 CA: 8 months, Sex: M
 Mother: 25, high school education, single
 Father: 28, education unknown
 CA of Brothers: 6
 CA of Sisters: none
 People in Home: 3
 Site: Family home
 Number of Ear Infections: none

 Test Name: *Observation of Communicative Interaction (OCI)*

<u>Question</u>	<u>Scores</u>
1. Appropriate tactile/kinesthetic stimulation	Often
2. Pleasure during mother/infant interaction	Often
3. Responds to child's distress	Often
4. Positions self to allow eye contact	Often
5. Smiles contingently at infant	Sometimes
6. Varies prosodic features	Often
7. Encourages "conversation"	Often
8. Responds contingently to infant	Often
9. Modifies interaction in response to negative cues from infant	Sometimes
10. Uses communication to teach language & concepts	Often

Test Name: *Home Inventory (Birth to 3)*

<u>Subscales</u>	<u>Percentile</u>
I. Emotional & Verbal Responsivity of Mother	Middle 50%
II. Avoidance of Restriction & Punishment	Lower 10%
III. Organization of Physical & Temporal Environment	Lower 10%
IV. Provision of Appropriate Play Materials	Middle 50%
V. Maternal Involvement with Child	Middle 50%
VI. Opportunities for Variety in Daily Stimulation	Middle 50%

Test Name: *Battelle Developmental Inventory*

<u>Domain</u>	<u>Raw Score</u>	<u>Age Equivalent</u>
Personal-Social	24	6
Adaptive	22	8
Motor	31	7
Communication	15	6
Cognitive	16	8
BDI Total Score	108	7

Subject # 11, CA: 8 months, Sex: F
 Mother: 29, high school education, married
 Father: 35, high school education
 CA of Brothers: 14, 13, 6
 CA of Sisters: 15, 14, 9
 People in Home: 9
 Site: Family Services Center
 Number of Ear Infections: none

Test Name: *Observation of Communicative Interaction (OCI)*

<u>Question</u>	<u>Scores</u>
1. Appropriate tactile/kinesthetic stimulation	Optimally
2. Pleasure during mother/infant interaction	Often
3. Responds to child's distress	Often
4. Positions self to allow eye contact	Often
5. Smiles contingently at infant	Often
6. Varies prosodic features	Often
7. Encourages "conversation"	Often
8. Responds contingently to infant	Often
9. Modifies interaction in response to negative cues from infant	Often
10. Uses communication to teach language & concepts	Often

Test Name: *Home Inventory (Birth to 3)*

<u>Subscales</u>	<u>Percentile</u>
I. Emotional & Verbal Responsivity of Mother	Upper 25%
II. Avoidance of Restriction & Punishment	Lower 25%
III. Organization of Physical & Temporal Environment	Middle 50%
IV. Provision of Appropriate Play Materials	Lower 25%
V. Maternal Involvement with Child	Middle 50%
VI. Opportunities for Variety in Daily Stimulation	Middle 50%

Test Name: *Battelle Developmental Inventory*

<u>Domain</u>	<u>Raw Score</u>	<u>Age Equivalent</u>
Personal-Social	25	6
Adaptive	22	8
Motor	30	7
Communication	15	6
Cognitive	16	8
BDI Total Score	108	7

Subject # 12 CA: 8 months, Sex: M
 Mother: 26, high school education, married
 Father: 27, high school education
 CA of Brothers: none
 CA of Sisters: 8, 4
 People in Home: 5
 Site: Family home
 Number of Ear Infections: 1

 Test Name: *Observation of Communicative Interaction (OCI)*

<u>Question</u>	<u>Scores</u>
1. Appropriate tactile/kinesthetic stimulation	Optimally
2. Pleasure during mother/infant interaction	Often
3. Responds to child's distress	Often
4. Positions self to allow eye contact	Often
5. Smiles contingently at infant	Often
6. Varies prosodic features	Often
7. Encourages "conversation"	Often
8. Responds contingently to infant	Often
9. Modifies interaction in response to negative cues from infant	Often
10. Uses communication to teach language & concepts	Often

Test Name: *Home Inventory (Birth to 3)*

<u>Subscales</u>	<u>Percentile</u>
I. Emotional & Verbal Responsivity of Mother	Middle 50%
II. Avoidance of Restriction & Punishment	Lower 25%
III. Organization of Physical & Temporal Environment	Middle 50%
IV. Provision of Appropriate Play Materials	Middle 50%
V. Maternal Involvement with Child	Middle 50%
VI. Opportunities for Variety in Daily Stimulation	Middle 50%

Test Name: *Battelle Developmental Inventory*

<u>Domain</u>	<u>Raw Score</u>	<u>Age Equivalent</u>
Personal-Social	26	7
Adaptive	19	7
Motor	29	7
Communication	17	8
Cognitive	15	8
BDI Total Score	106	7

Subject # 13 CA: 8 months, Sex: F
 Mother: 41, 10th grade, single
 Father: 41, unknown education
 CA of Brothers: 14, 13, 9, 7, 5, 3
 CA of Sisters: 17, 11
 People in Home: 10
 Site: Family Services Center
 Number of Ear Infections: none

 Test Name: *Observation of Communicative Interaction (OCI)*

<u>Question</u>	<u>Scores</u>
1. Appropriate tactile/kinesthetic stimulation	Optimally
2. Pleasure during mother/infant interaction	Often
3. Responds to child's distress	Often
4. Positions self to allow eye contact	Often
5. Smiles contingently at infant	Often
6. Varies prosodic features	Often
7. Encourages "conversation"	Sometimes
8. Responds contingently to infant	Often
9. Modifies interaction in response to negative cues from infant	Optimally
10. Uses communication to teach language & concepts	Sometimes

Test Name: *Home Inventory (Birth to 3)*

<u>Subscales</u>	<u>Percentile</u>
I. Emotional & Verbal Responsivity of Mother	Middle 50%
II. Avoidance of Restriction & Punishment	Lower 10%
III. Organization of Physical & Temporal Environment	Lower 25%
IV. Provision of Appropriate Play Materials	Lower 25%
V. Maternal Involvement with Child	Middle 50%
VI. Opportunities for Variety in Daily Stimulation	Middle 50%

Test Name: *Battelle Developmental Inventory*

<u>Domain</u>	<u>Raw Score</u>	<u>Age Equivalent</u>
Personal-Social	26	7
Adaptive	21	8
Motor	30	7
Communication	16	7
Cognitive	15	8
BDI Total Score	108	7

Subject # 14 CA: 10 months, Sex: M
 Mother: 19, 11th grade, single
 Father: 21, 11th grade
 CA of Brothers: none
 CA of Sisters: 4
 People in Home: 4
 Site: Family home
 Number of Ear Infections: none

Test Name: *Observation of Communicative Interaction (OCI)*

<u>Question</u>	<u>Scores</u>
1. Appropriate tactile/kinesthetic stimulation	Optimally
2. Pleasure during mother/infant interaction	Often
3. Responds to child's distress	Often
4. Positions self to allow eye contact	Often
5. Smiles contingently at infant	Often
6. Varies prosodic features	Often
7. Encourages "conversation"	Often
8. Responds contingently to infant	Often
9. Modifies interaction in response to negative cues from infant	Optimally
10. Uses communication to teach language & concepts	Often

Test Name: *Home Inventory (Birth to 3)*

<u>Subscales</u>	<u>Percentile</u>
I. Emotional & Verbal Responsivity of Mother	Middle 50%
II. Avoidance of Restriction & Punishment	Lower 25%
III. Organization of Physical & Temporal Environment	Middle 50%
IV. Provision of Appropriate Play Materials	Lower 25%
V. Maternal Involvement with Child	Middle 50%
VI. Opportunities for Variety in Daily Stimulation	Lower 25%

Test Name: *Battelle Developmental Inventory*

<u>Domain</u>	<u>Raw Score</u>	<u>Age Equivalent</u>
Personal-Social	28	8
Adaptive	26	10
Motor	35	9
Communication	17	8
Cognitive	17	9
BDI Total Score	123	9

Subject # 15 CA: 10 months, Sex: M
 Mother: 31, some college, married
 Father: 32, high school education
 CA of Brothers: none
 CA of Sisters: 5
 People in Home: 6
 Site: Home day care
 Number of Ear Infections: none

Test Name: *Observation of Communicative Interaction (OCI)*

<u>Question</u>	<u>Scores</u>
1. Appropriate tactile/kinesthetic stimulation	Optimally
2. Pleasure during mother/infant interaction	Often
3. Responds to child's distress	Often
4. Positions self to allow eye contact	Often
5. Smiles contingently at infant	Optimally
6. Varies prosodic features	Often
7. Encourages "conversation"	Often
8. Responds contingently to infant	Optimally
9. Modifies interaction in response to negative cues from infant	Optimally
10. Uses communication to teach language & concepts	Often

Test Name: *Home Inventory (Birth to 3)*

<u>Subscales</u>	<u>Percentile</u>
I. Emotional & Verbal Responsivity of Mother	Middle 50%
II. Avoidance of Restriction & Punishment	Middle 50%
III. Organization of Physical & Temporal Environment	Middle 50%
IV. Provision of Appropriate Play Materials	Lower 25%
V. Maternal Involvement with Child	Middle 50%
VI. Opportunities for Variety in Daily Stimulation	Middle 50%

Test Name: *Battelle Developmental Inventory*

<u>Domain</u>	<u>Raw Score</u>	<u>Age Equivalent</u>
Personal-Social	35	10
Adaptive	25	10
Motor	36	9
Communication	18	9
Cognitive	18	10
BDI Total Score	132	10

Subject # 16 CA: 10 months, Sex: F
 Mother: 23, high school, single
 Father: 24 high school education
 CA of Brothers: none
 CA of Sisters: none
 People in Home: 3
 Site: Home day care
 Number of Ear Infections: none

Test Name: *Observation of Communicative Interaction (OCI)*

<u>Question</u>	<u>Scores</u>
1. Appropriate tactile/kinesthetic stimulation	Optimally
2. Pleasure during mother/infant interaction	Often
3. Responds to child's distress	Often
4. Positions self to allow eye contact	Often
5. Smiles contingently at infant	Often
6. Varies prosodic features	Often
7. Encourages "conversation"	Sometimes
8. Responds contingently to infant	Often
9. Modifies interaction in response to negative cues from infant	Often
10. Uses communication to teach language & concepts	Often

Test Name: *Home Inventory (Birth to 3)*

<u>Subscales</u>	<u>Percentile</u>
I. Emotional & Verbal Responsivity of Mother	Middle 50%
II. Avoidance of Restriction & Punishment	Lower 25%
III. Organization of Physical & Temporal Environment	Middle 50%
IV. Provision of Appropriate Play Materials	Lower 25%
V. Maternal Involvement with Child	Middle 50%
VI. Opportunities for Variety in Daily Stimulation	Middle 50%

Test Name: *Battelle Developmental Inventory*

<u>Domain</u>	<u>Raw Score</u>	<u>Age Equivalent</u>
Personal-Social	33	10
Adaptive	27	10
Motor	36	10
Communication	17	8
Cognitive	19	11
BDI Total Score	132	10

Subject # 17 CA: 10 months, Sex: F

Mother: 21, high school, single

Father: 26, high school education

CA of Brothers: none

CA of Sisters: 4

People in Home: 4

Site: Day care center

Number of Ear Infections: none

Test Name: *Observation of Communicative Interaction (OCI)*

<u>Question</u>	<u>Scores</u>
1. Appropriate tactile/kinesthetic stimulation	Optimally
2. Pleasure during mother/infant interaction	Often
3. Responds to child's distress	Often
4. Positions self to allow eye contact	Often
5. Smiles contingently at infant	Optimally
6. Varies prosodic features	Often
7. Encourages "conversation"	Often
8. Responds contingently to infant	Optimally
9. Modifies interaction in response to negative cues from infant	Optimally
10. Uses communication to teach language & concepts	Often

Test Name: *Home Inventory (Birth to 3)*

<u>Subscales</u>	<u>Percentile</u>
I. Emotional & Verbal Responsivity of Mother	Middle 50%
II. Avoidance of Restriction & Punishment	Middle 50%
III. Organization of Physical & Temporal Environment	Middle 50%
IV. Provision of Appropriate Play Materials	Lower 25%
V. Maternal Involvement with Child	Middle 50%
VI. Opportunities for Variety in Daily Stimulation	Middle 50%

Test Name: *Battelle Developmental Inventory*

<u>Domain</u>	<u>Raw Score</u>	<u>Age Equivalent</u>
Personal-Social	35	10
Adaptive	25	10
Motor	36	9
Communication	18	9
Cognitive	18	10
BDI Total Score	132	10

Subject # 18 CA: 10 months, Sex: F
 Mother: 16, 11th. grade, single
 Father: 19, 12th grade
 CA of Brothers: none
 CA of Sisters: none
 People in Home: 6
 Site: Family service center
 Number of Ear Infections: 1

 Test Name: *Observation of Communicative Interaction (OCI)*

<u>Question</u>	<u>Scores</u>
1. Appropriate tactile/kinesthetic stimulation	Optimally
2. Pleasure during mother/infant interaction	Often
3. Responds to child's distress	Often
4. Positions self to allow eye contact	Optimally
5. Smiles contingently at infant	Optimally
6. Varies prosodic features	Often
7. Encourages "conversation"	Often
8. Responds contingently to infant	Optimally
9. Modifies interaction in response to negative cues from infant	Optimally
10. Uses communication to teach language & concepts	Often

Test Name: *Home Inventory (Birth to 3)*

<u>Subscales</u>	<u>Percentile</u>
I. Emotional & Verbal Responsivity of Mother	Middle 50%
II. Avoidance of Restriction & Punishment	Lower 25%
III. Organization of Physical & Temporal Environment	Middle 50%
IV. Provision of Appropriate Play Materials	Middle 50%
V. Maternal Involvement with Child	Middle 50%
VI. Opportunities for Variety in Daily Stimulation	Lower 25%

Test Name: *Battelle Developmental Inventory*

<u>Domain</u>	<u>Raw Score</u>	<u>Age Equivalent</u>
Personal-Social	37	11
Adaptive	23	9
Motor	36	9
Communication	19	10
Cognitive	19	11
BDI Total Score	134	10

Subject # 19 CA: 10 months, Sex: M
 Mother: 26, some college, single
 Father: 26 high school education
 CA of Brothers: 4
 CA of Sisters: none
 People in Home: 4
 Site: Family home
 Number of Ear Infections: 1

Test Name: *Observation of Communicative Interaction (OCI)*

<u>Question</u>	<u>Scores</u>
1. Appropriate tactile/kinesthetic stimulation	Optimally
2. Pleasure during mother/infant interaction	Often
3. Responds to child's distress	Often
4. Positions self to allow eye contact	Often
5. Smiles contingently at infant	Often
6. Varies prosodic features	Sometimes
7. Encourages "conversation"	Often
8. Responds contingently to infant	Often
9. Modifies interaction in response to negative cues from infant	Often
10. Uses communication to teach language & concepts	Often

Test Name: *Home Inventory (Birth to 3)*

<u>Subscales</u>	<u>Percentile</u>
I. Emotional & Verbal Responsivity of Mother	Middle 50%
II. Avoidance of Restriction & Punishment	Lower 10%
III. Organization of Physical & Temporal Environment	Middle 50%
IV. Provision of Appropriate Play Materials	Lower 25%
V. Maternal Involvement with Child	Middle 50%
VI. Opportunities for Variety in Daily Stimulation	Middle 50%

Test Name: *Battelle Developmental Inventory*

<u>Domain</u>	<u>Raw Score</u>	<u>Age Equivalent</u>
Personal-Social	33	10
Adaptive	25	10
Motor	38	10
Communication	18	9
Cognitive	18	10
BDI Total Score	132	10

Subject # 20 CA: 10 months, Sex: M
 Mother: 27, working on GED, single
 Father: 24, education unknown
 CA of Brothers: 1, 6
 CA of Sisters: none
 People in Home: 3
 Site: Family services center
 Number of Ear Infections: none

Test Name: *Observation of Communicative Interaction (OCI)*

<u>Question</u>	<u>Scores</u>
1. Appropriate tactile/kinesthetic stimulation	Optimally
2. Pleasure during mother/infant interaction	Often
3. Responds to child's distress	Often
4. Positions self to allow eye contact	Often
5. Smiles contingently at infant	Optimally
6. Varies prosodic features	Often
7. Encourages "conversation"	Often
8. Responds contingently to infant	Often
9. Modifies interaction in response to negative cues from infant	Sometimes
10. Uses communication to teach language & concepts	Often

Test Name: *Home Inventory (Birth to 3)*

<u>Subscales</u>	<u>Percentile</u>
I. Emotional & Verbal Responsivity of Mother	Middle 50%
II. Avoidance of Restriction & Punishment	Lower 10%
III. Organization of Physical & Temporal Environment	Middle 50%
IV. Provision of Appropriate Play Materials	Lower 25%
V. Maternal Involvement with Child	Middle 50%
VI. Opportunities for Variety in Daily Stimulation	Middle 50%

Test Name: *Battelle Developmental Inventory*

<u>Domain</u>	<u>Raw Score</u>	<u>Age Equivalent</u>
Personal-Social	34	10
Adaptive	24	9
Motor	37	9
Communication	18	9
Cognitive	19	11
BDI Total Score	132	10

Subject # 21: 10 months, Sex: M
 Mother: 28, high school, married
 Father: 27, high school education
 CA of Brothers: 10, 2
 CA of Sisters: none
 People in Home: 5
 Site: Home day care
 Number of Ear Infections: none

 Test Name: *Observation of Communicative Interaction (OCI)*

<u>Question</u>	<u>Scores</u>
1. Appropriate tactile/kinesthetic stimulation	Optimally
2. Pleasure during mother/infant interaction	Often
3. Responds to child's distress	Often
4. Positions self to allow eye contact	Often
5. Smiles contingently at infant	Optimally
6. Varies prosodic features	Optimally
7. Encourages "conversation"	Optimally
8. Responds contingently to infant	Optimally
9. Modifies interaction in response to negative cues from infant	Optimally
10. Uses communication to teach language & concepts	Often

Test Name: *Home Inventory (Birth to 3)*

<u>Subscales</u>	<u>Percentile</u>
I. Emotional & Verbal Responsivity of Mother	Middle 50%
II. Avoidance of Restriction & Punishment	Lower 25%
III. Organization of Physical & Temporal Environment	Middle 50%
IV. Provision of Appropriate Play Materials	Middle 50%
V. Maternal Involvement with Child	Middle 50%
VI. Opportunities for Variety in Daily Stimulation	Middle 50%

Test Name: *Battelle Developmental Inventory*

<u>Domain</u>	<u>Raw Score</u>	<u>Age Equivalent</u>
Personal-Social	36	11
Adaptive	25	10
Motor	40	10
Communication	19	10
Cognitive	19	11
BDI Total Score	139	10

Subject # 22 CA: 11 months, Sex: M
 Mother: 29, high school, married
 Father: 33, high school education
 CA of Brothers: 4
 CA of Sisters: 11 months (twin with Down syndrome), 9
 People in Home: 6
 Site: Home day care
 Number of Ear Infections: 1

Test Name: *Observation of Communicative Interaction (OCI)*

<u>Question</u>	<u>Scores</u>
1. Appropriate tactile/kinesthetic stimulation	Optimally
2. Pleasure during mother/infant interaction	Often
3. Responds to child's distress	Often
4. Positions self to allow eye contact	Often
5. Smiles contingently at infant	Often
6. Varies prosodic features	Often
7. Encourages "conversation"	Often
8. Responds contingently to infant	Often
9. Modifies interaction in response to negative cues from infant	Optimally
10. Uses communication to teach language & concepts	Often

Test Name: *Home Inventory (Birth to 3)*

<u>Subscales</u>	<u>Percentile</u>
I. Emotional & Verbal Responsivity of Mother	Middle 50%
II. Avoidance of Restriction & Punishment	Middle 50%
III. Organization of Physical & Temporal Environment	Middle 50%
IV. Provision of Appropriate Play Materials	Lower 25%
V. Maternal Involvement with Child	Middle 50%
VI. Opportunities for Variety in Daily Stimulation	Middle 50%

Test Name: *Battelle Developmental Inventory*

<u>Domain</u>	<u>Raw Score</u>	<u>Age Equivalent</u>
Personal-Social	35	10
Adaptive	25	10
Motor	44	11
Communication	19	10
Cognitive	18	10
BDI Total Score	141	10

Subject # 23 CA: 11 months, Sex: F
 Mother: 26, some college, married
 Father: unknown, education unknown
 CA of Brothers: none
 CA of Sisters: none
 People in Home: 4
 Site: Day care center
 Number of Ear Infections: 1

Test Name: *Observation of Communicative Interaction (OCI)*

<u>Question</u>	<u>Scores</u>
1. Appropriate tactile/kinesthetic stimulation	Optimally
2. Pleasure during mother/infant interaction	Often
3. Responds to child's distress	Often
4. Positions self to allow eye contact	Sometimes
5. Smiles contingently at infant	Often
6. Varies prosodic features	Often
7. Encourages "conversation"	Sometimes
8. Responds contingently to infant	Often
9. Modifies interaction in response to negative cues from infant	Often
10. Uses communication to teach language & concepts	rarely/never

Test Name: *Home Inventory (Birth to 3)*

<u>Subscales</u>	<u>Percentile</u>
I. Emotional & Verbal Responsivity of Mother	Middle 50%
II. Avoidance of Restriction & Punishment	Lower 10%
III. Organization of Physical & Temporal Environment	Middle 50%
IV. Provision of Appropriate Play Materials	Lower 25%
V. Maternal Involvement with Child	Middle 50%
VI. Opportunities for Variety in Daily Stimulation	Lower 25%

Test Name: *Battelle Developmental Inventory*

<u>Domain</u>	<u>Raw Score</u>	<u>Age Equivalent</u>
Personal-Social	35	10
Adaptive	25	10
Motor	45	11
Communication	18	9
Cognitive	18	10
BDI Total Score	141	10

Subject # 24 CA: 11 months, Sex: M
 Mother: 21, high school, single
 Father: 23, high school education
 CA of Brothers: none
 CA of Sisters: none
 People in Home: 5
 Site: Family home
 Number of Ear Infections: none

Test Name: *Observation of Communicative Interaction (OCI)*

<u>Question</u>	<u>Scores</u>
1. Appropriate tactile/kinesthetic stimulation	Optimally
2. Pleasure during mother/infant interaction	Often
3. Responds to child's distress	Often
4. Positions self to allow eye contact	Often
5. Smiles contingently at infant	Often
6. Varies prosodic features	Often
7. Encourages "conversation"	Often
8. Responds contingently to infant	Often
9. Modifies interaction in response to negative cues from infant	Sometimes
10. Uses communication to teach language & concepts	Sometimes

Test Name: *Home Inventory (Birth to 3)*

<u>Subscales</u>	<u>Percentile</u>
I. Emotional & Verbal Responsivity of Mother	Middle 50%
II. Avoidance of Restriction & Punishment	Lower 25%
III. Organization of Physical & Temporal Environment	Middle 50%
IV. Provision of Appropriate Play Materials	Middle 50%
V. Maternal Involvement with Child	Middle 50%
VI. Opportunities for Variety in Daily Stimulation	Lower 25%

Test Name: *Battelle Developmental Inventory*

<u>Domain</u>	<u>Raw Score</u>	<u>Age Equivalent</u>
Personal-Social	35	10
Adaptive	25	10
Motor	40	10
Communication	18	9
Cognitive	18	10
BDI Total Score	136	10

Subject # 25 CA: 11 months, Sex: M
 Mother: 27, some college, single
 Father: age and education unknown
 CA of Brothers: none
 CA of Sisters: 3
 People in Home:
 Site: Family home
 Number of Ear Infections: none

Test Name: *Observation of Communicative Interaction (OCI)*

<u>Question</u>	<u>Scores</u>
1. Appropriate tactile/kinesthetic stimulation	Often
2. Pleasure during mother/infant interaction	Often
3. Responds to child's distress	Often
4. Positions self to allow eye contact	Often
5. Smiles contingently at infant	Often
6. Varies prosodic features	Often
7. Encourages "conversation"	Often
8. Responds contingently to infant	Often
9. Modifies interaction in response to negative cues from infant	Sometimes
10. Uses communication to teach language & concepts	Often

Test Name: *Home Inventory (Birth to 3)*

<u>Subscales</u>	<u>Percentile</u>
I. Emotional & Verbal Responsivity of Mother	Middle 50%
II. Avoidance of Restriction & Punishment	Lower 10%
III. Organization of Physical & Temporal Environment	Middle 50%
IV. Provision of Appropriate Play Materials	Lower 25%
V. Maternal Involvement with Child	Middle 50%
VI. Opportunities for Variety in Daily Stimulation	Middle 50%

Test Name: *Battelle Developmental Inventory*

<u>Domain</u>	<u>Raw Score</u>	<u>Age Equivalent</u>
Personal-Social	35	10
Adaptive	29	11
Motor	42	10
Communication	18	9
Cognitive	19	11
BDI Total Score	143	11

Subject # 26 CA: 8 months, Sex: M
 Mother: 25, working on GED, married
 Father: 59, education unknown
 CA of Brothers: 1
 CA of Sisters: 5
 People in Home: 4
 Site: Family services center
 Number of Ear Infections: 2

Test Name: *Observation of Communicative Interaction (OCI)*

<u>Question</u>	<u>Scores</u>
1. Appropriate tactile/kinesthetic stimulation	Often
2. Pleasure during mother/infant interaction	Often
3. Responds to child's distress	Often
4. Positions self to allow eye contact	Often
5. Smiles contingently at infant	Optimally
6. Varies prosodic features	Often
7. Encourages "conversation"	Often
8. Responds contingently to infant	Optimally
9. Modifies interaction in response to negative cues from infant	Often
10. Uses communication to teach language & concepts	Sometimes

Test Name: *Home Inventory (Birth to 3)*

<u>Subscales</u>	<u>Percentile</u>
I. Emotional & Verbal Responsivity of Mother	Middle 50%
II. Avoidance of Restriction & Punishment	Lower 10%
III. Organization of Physical & Temporal Environment	Middle 50%
IV. Provision of Appropriate Play Materials	Lower 25%
V. Maternal Involvement with Child	Middle 50%
VI. Opportunities for Variety in Daily Stimulation	Lower 25%

Test Name: *Battelle Developmental Inventory*

<u>Domain</u>	<u>Raw Score</u>	<u>Age Equivalent</u>
Personal-Social	25	6
Adaptive	24	9
Motor	41	10
Communication	17	8
Cognitive	16	8
BDI Total Score	123	9

Subject # 27 CA: 8 months, Sex: M
 Mother: 23, some college, single
 Father: 25, high school education
 CA of Brothers: none
 CA of Sisters: 5
 People in Home: 2
 Site: Home day care
 Number of Ear Infections: none

Test Name: *Observation of Communicative Interaction (OCI)*

<u>Question</u>	<u>Scores</u>
1. Appropriate tactile/kinesthetic stimulation	Often
2. Pleasure during mother/infant interaction	Often
3. Responds to child's distress	Often
4. Positions self to allow eye contact	Often
5. Smiles contingently at infant	Often
6. Varies prosodic features	Often
7. Encourages "conversation"	Often
8. Responds contingently to infant	Often
9. Modifies interaction in response to negative cues from infant	Often
10. Uses communication to teach language & concepts	Often

Test Name: *Home Inventory (Birth to 3)*

<u>Subscales</u>	<u>Percentile</u>
I. Emotional & Verbal Responsivity of Mother	Middle 50%
II. Avoidance of Restriction & Punishment	Lower 25%
III. Organization of Physical & Temporal Environment	Middle 50%
IV. Provision of Appropriate Play Materials	Lower 25%
V. Maternal Involvement with Child	Lower 25%
VI. Opportunities for Variety in Daily Stimulation	Middle 50%

Test Name: *Battelle Developmental Inventory*

<u>Domain</u>	<u>Raw Score</u>	<u>Age Equivalent</u>
Personal-Social	26	7
Adaptive	19	7
Motor	29	7
Communication	17	8
Cognitive	15	8
BDI Total Score	106	7

Subject # 28 CA: 8 months, Sex: M
 Mother: 29, some college, married
 Father: 31, high school education
 CA of Brothers: none
 CA of Sisters: 2
 People in Home: 4
 Site: Day care center
 Number of Ear Infections: none

 Test Name: *Observation of Communicative Interaction (OCI)*

<u>Question</u>	<u>Scores</u>
1. Appropriate tactile/kinesthetic stimulation	Often
2. Pleasure during mother/infant interaction	Often
3. Responds to child's distress	Often
4. Positions self to allow eye contact	Often
5. Smiles contingently at infant	Optimally
6. Varies prosodic features	Often
7. Encourages "conversation"	Often
8. Responds contingently to infant	Optimally
9. Modifies interaction in response to negative cues from infant	Sometimes
10. Uses communication to teach language & concepts	Often

Test Name: *Home Inventory (Birth to 3)*

<u>Subscales</u>	<u>Percentile</u>
I. Emotional & Verbal Responsivity of Mother	Middle 50%
II. Avoidance of Restriction & Punishment	Middle 50%
III. Organization of Physical & Temporal Environment	Middle 50%
IV. Provision of Appropriate Play Materials	Lower 25%
V. Maternal Involvement with Child	Middle 50%
VI. Opportunities for Variety in Daily Stimulation	Middle 50%

Test Name: *Battelle Developmental Inventory*

<u>Domain</u>	<u>Raw Score</u>	<u>Age Equivalent</u>
Personal-Social	24	6
Adaptive	22	8
Motor	31	7
Communication	15	6
Cognitive	16	8
BDI Total Score	108	7

Subject # 29 CA: 9 months, Sex: M
 Mother: 25, working on GED, single
 Father: age and education unknown
 CA of Brothers: none
 CA of Sisters: 2
 People in Home: 4
 Site: Health department parenting class
 Number of Ear Infections: none

Test Name: *Observation of Communicative Interaction (OCI)*

<u>Question</u>	<u>Scores</u>
1. Appropriate tactile/kinesthetic stimulation	Often
2. Pleasure during mother/infant interaction	Often
3. Responds to child's distress	Often
4. Positions self to allow eye contact	Often
5. Smiles contingently at infant	Often
6. Varies prosodic features	Often
7. Encourages "conversation"	Often
8. Responds contingently to infant	Sometimes
9. Modifies interaction in response to negative cues from infant	Often
10. Uses communication to teach language & concepts	Often

Test Name: *Home Inventory (Birth to 3)*

<u>Subscales</u>	<u>Percentile</u>
I. Emotional & Verbal Responsivity of Mother	Middle 50%
II. Avoidance of Restriction & Punishment	Lower 10%
III. Organization of Physical & Temporal Environment	Middle 50%
IV. Provision of Appropriate Play Materials	Lower 25%
V. Maternal Involvement with Child	Middle 50%
VI. Opportunities for Variety in Daily Stimulation	Middle 50%

Test Name: *Battelle Developmental Inventory*

<u>Domain</u>	<u>Raw Score</u>	<u>Age Equivalent</u>
Personal-Social	25	6
Adaptive	24	9
Motor	41	10
Communication	17	8
Cognitive	16	8
BDI Total Score	123	9

Subject # 30 CA: 9 months, Sex: M
 Mother: 18, working on GED, single
 Father: 27, education unknown
 CA of Brothers: none
 CA of Sisters: none
 People in Home: 2
 Site: Health department parenting class
 Number of Ear Infections: none

Test Name: *Observation of Communicative Interaction (OCI)*

<u>Question</u>	<u>Scores</u>
1. Appropriate tactile/kinesthetic stimulation	Often
2. Pleasure during mother/infant interaction	Often
3. Responds to child's distress	Often
4. Positions self to allow eye contact	Often
5. Smiles contingently at infant	Optimally
6. Varies prosodic features	Often
7. Encourages "conversation"	Often
8. Responds contingently to infant	Often
9. Modifies interaction in response to negative cues from infant	Often
10. Uses communication to teach language & concepts	Often

Test Name: *Home Inventory (Birth to 3)*

<u>Subscales</u>	<u>Percentile</u>
I. Emotional & Verbal Responsivity of Mother	Middle 50%
II. Avoidance of Restriction & Punishment	Middle 50%
III. Organization of Physical & Temporal Environment	Middle 50%
IV. Provision of Appropriate Play Materials	Lower 25%
V. Maternal Involvement with Child	Middle 50%
VI. Opportunities for Variety in Daily Stimulation	Lower 25%

Test Name: *Battelle Developmental Inventory*

<u>Domain</u>	<u>Raw Score</u>	<u>Age Equivalent</u>
Personal-Social	25	6
Adaptive	24	9
Motor	41	10
Communication	17	8
Cognitive	16	8
BDI Total Score	123	9

Subject # 31 CA: 9 months, Sex: M
 Mother: 24, working on GED, married
 Father: age and education unknown
 CA of Brothers: 6, 6
 CA of Sisters: none
 People in Home: 4
 Site: Family services center
 Number of Ear Infections: none

 Test Name: *Observation of Communicative Interaction (OCI)*

<u>Question</u>	<u>Scores</u>
1. Appropriate tactile/kinesthetic stimulation	Often
2. Pleasure during mother/infant interaction	Often
3. Responds to child's distress	Often
4. Positions self to allow eye contact	Often
5. Smiles contingently at infant	Often
6. Varies prosodic features	Often
7. Encourages "conversation"	Often
8. Responds contingently to infant	Often
9. Modifies interaction in response to negative cues from infant	Often
10. Uses communication to teach language & concepts	Often

Test Name: *Home Inventory (Birth to 3)*

<u>Subscales</u>	<u>Percentile</u>
I. Emotional & Verbal Responsivity of Mother	Middle 50%
II. Avoidance of Restriction & Punishment	Middle 50%
III. Organization of Physical & Temporal Environment	Lower 25%
IV. Provision of Appropriate Play Materials	Lower 25%
V. Maternal Involvement with Child	Middle 50%
VI. Opportunities for Variety in Daily Stimulation	Lower 25%

Test Name: *Battelle Developmental Inventory*

<u>Domain</u>	<u>Raw Score</u>	<u>Age Equivalent</u>
Personal-Social	35	10
Adaptive	25	10
Motor	36	9
Communication	18	9
Cognitive	18	10
BDI Total Score	132	10

Subject # 32 CA: 10 months, Sex: M
 Mother: 30, working on GED, single
 Father: 30, high school
 CA of Brothers: 3, 4
 CA of Sisters: 9
 People in Home: 5
 Site: Family services center
 Number of Ear Infections: none

Test Name: *Observation of Communicative Interaction (OCI)*

<u>Question</u>	<u>Scores</u>
1. Appropriate tactile/kinesthetic stimulation	Optimally
2. Pleasure during mother/infant interaction	Often
3. Responds to child's distress	Often
4. Positions self to allow eye contact	Often
5. Smiles contingently at infant	Often
6. Varies prosodic features	Often
7. Encourages "conversation"	Often
8. Responds contingently to infant	Often
9. Modifies interaction in response to negative cues from infant	Sometimes
10. Uses communication to teach language & concepts	Sometimes

Test Name: *Home Inventory (Birth to 3)*

<u>Subscales</u>	<u>Percentile</u>
I. Emotional & Verbal Responsivity of Mother	Middle 50%
II. Avoidance of Restriction & Punishment	Lower 25%
III. Organization of Physical & Temporal Environment	Middle 50%
IV. Provision of Appropriate Play Materials	Lower 25%
V. Maternal Involvement with Child	Middle 50%
VI. Opportunities for Variety in Daily Stimulation	Middle 50%

Test Name: *Battelle Developmental Inventory*

<u>Domain</u>	<u>Raw Score</u>	<u>Age Equivalent</u>
Personal-Social	35	10
Adaptive	25	10
Motor	36	9
Communication	18	9
Cognitive	18	10
BDI Total Score	132	10

Subject # 33 CA: 10 months, Sex: F
 Mother: 27, working on GED, married
 Father: 29, education unknown
 CA of Brothers: none
 CA of Sisters: none
 People in Home: 3
 Site: Health department parenting class
 Number of Ear Infections: none

 Test Name: *Observation of Communicative Interaction (OCI)*

<u>Question</u>	<u>Scores</u>
1. Appropriate tactile/kinesthetic stimulation	Often
2. Pleasure during mother/infant interaction	Often
3. Responds to child's distress	Often
4. Positions self to allow eye contact	Often
5. Smiles contingently at infant	Often
6. Varies prosodic features	Often
7. Encourages "conversation"	Often
8. Responds contingently to infant	Often
9. Modifies interaction in response to negative cues from infant	Often
10. Uses communication to teach language & concepts	Often

Test Name: *Home Inventory (Birth to 3)*

<u>Subscales</u>	<u>Percentile</u>
I. Emotional & Verbal Responsivity of Mother	Middle 50%
II. Avoidance of Restriction & Punishment	Middle 50%
III. Organization of Physical & Temporal Environment	Middle 50%
IV. Provision of Appropriate Play Materials	Lower 25%
V. Maternal Involvement with Child	Middle 50%
VI. Opportunities for Variety in Daily Stimulation	Lower 25%

Test Name: *Battelle Developmental Inventory*

<u>Domain</u>	<u>Raw Score</u>	<u>Age Equivalent</u>
Personal-Social	35	10
Adaptive	25	10
Motor	36	9
Communication	18	9
Cognitive	18	10
BDI Total Score	132	10

Subject # 34 CA: 10 months, Sex: M
 Mother: 24, working on GED, married
 Father: 30, education unknown
 CA of Brothers: 2, 4
 CA of Sisters: none
 People in Home: 4
 Site: Health department parenting class
 Number of Ear Infections: none

 Test Name: *Observation of Communicative Interaction (OCI)*

<u>Question</u>	<u>Scores</u>
1. Appropriate tactile/kinesthetic stimulation	Often
2. Pleasure during mother/infant interaction	Often
3. Responds to child's distress	Often
4. Positions self to allow eye contact	Often
5. Smiles contingently at infant	Often
6. Varies prosodic features	Often
7. Encourages "conversation"	Often
8. Responds contingently to infant	Often
9. Modifies interaction in response to negative cues from infant	Often
10. Uses communication to teach language & concepts	Often

Test Name: *Home Inventory (Birth to 3)*

<u>Subscales</u>	<u>Percentile</u>
I. Emotional & Verbal Responsivity of Mother	Middle 50%
II. Avoidance of Restriction & Punishment	Middle 50%
III. Organization of Physical & Temporal Environment	Middle 50%
IV. Provision of Appropriate Play Materials	Lower 25%
V. Maternal Involvement with Child	Middle 50%
VI. Opportunities for Variety in Daily Stimulation	Lower 25%

Test Name: *Battelle Developmental Inventory*

<u>Domain</u>	<u>Raw Score</u>	<u>Age Equivalent</u>
Personal-Social	35	10
Adaptive	25	10
Motor	44	11
Communication	19	10
Cognitive	18	10
BDI Total Score	141	10

Subject # 35 CA: 10 months, Sex: F
 Mother: 21, working on GED, single
 Father: 26, high school
 CA of Brothers: 1, 3
 CA of Sisters: 6
 People in Home: 4
 Site: Home day care
 Number of Ear Infections: none

 Test Name: *Observation of Communicative Interaction (OCI)*

<u>Question</u>	<u>Scores</u>
1. Appropriate tactile/kinesthetic stimulation	Often
2. Pleasure during mother/infant interaction	Often
3. Responds to child's distress	Often
4. Positions self to allow eye contact	Often
5. Smiles contingently at infant	Often
6. Varies prosodic features	Often
7. Encourages "conversation"	Often
8. Responds contingently to infant	Often
9. Modifies interaction in response to negative cues from infant	Often
10. Uses communication to teach language & concepts	Often

Test Name: *Home Inventory (Birth to 3)*

<u>Subscales</u>	<u>Percentile</u>
I. Emotional & Verbal Responsivity of Mother	Middle 50%
II. Avoidance of Restriction & Punishment	Lower 25%
III. Organization of Physical & Temporal Environment	Middle 50%
IV. Provision of Appropriate Play Materials	Lower 25%
V. Maternal Involvement with Child	Middle 50%
VI. Opportunities for Variety in Daily Stimulation	Lower 25%

Test Name: *Battelle Developmental Inventory*

<u>Domain</u>	<u>Raw Score</u>	<u>Age Equivalent</u>
Personal-Social	35	10
Adaptive	25	10
Motor	36	9
Communication	18	9
Cognitive	18	10
BDI Total Score	132	10

Subject # 36 CA: 10 months, Sex: F
 Mother: 18, working on GED, single
 Father: 24, high school
 CA of Brothers: none
 CA of Sisters: none
 People in Home: 8 (subject lives with grandparents)
 Site: Family home
 Number of Ear Infections: none

Test Name: *Observation of Communicative Interaction (OCI)*

<u>Question</u>	<u>Scores</u>
1. Appropriate tactile/kinesthetic stimulation	Optimally
2. Pleasure during mother/infant interaction	Often
3. Responds to child's distress	Often
4. Positions self to allow eye contact	Often
5. Smiles contingently at infant	Optimally
6. Varies prosodic features	Often
7. Encourages "conversation"	Often
8. Responds contingently to infant	Optimally
9. Modifies interaction in response to negative cues from infant	Optimally
10. Uses communication to teach language & concepts	Often

Test Name: *Home Inventory (Birth to 3)*

<u>Subscales</u>	<u>Percentile</u>
I. Emotional & Verbal Responsivity of Mother	Middle 50%
II. Avoidance of Restriction & Punishment	Middle 50%
III. Organization of Physical & Temporal Environment	Middle 50%
IV. Provision of Appropriate Play Materials	Lower 25%
V. Maternal Involvement with Child	Middle 50%
VI. Opportunities for Variety in Daily Stimulation	Middle 50%

Test Name: *Battelle Developmental Inventory*

<u>Domain</u>	<u>Raw Score</u>	<u>Age Equivalent</u>
Personal-Social	35	10
Adaptive	25	10
Motor	44	11
Communication	19	10
Cognitive	18	10
BDI Total Score	141	10

Subject # 37 CA: 11 months, Sex: M
 Mother: 32, 11th grade
 Father: 28, 12th grade
 CA of Brothers: none
 CA of Sisters: none
 People in Home: 2
 Site: Health department parenting class
 Number of Ear Infections: 1

 Test Name: *Observation of Communicative Interaction (OCI)*

<u>Question</u>	<u>Scores</u>
1. Appropriate tactile/kinesthetic stimulation	Often
2. Pleasure during mother/infant interaction	Often
3. Responds to child's distress	Often
4. Positions self to allow eye contact	Often
5. Smiles contingently at infant	Often
6. Varies prosodic features	Often
7. Encourages "conversation"	Often
8. Responds contingently to infant	Sometimes
9. Modifies interaction in response to negative cues from infant	Often
10. Uses communication to teach language & concepts	Often

Test Name: *Home Inventory (Birth to 3)*

<u>Subscales</u>	<u>Percentile</u>
I. Emotional & Verbal Responsivity of Mother	Middle 50%
II. Avoidance of Restriction & Punishment	Middle 50%
III. Organization of Physical & Temporal Environment	Middle 50%
IV. Provision of Appropriate Play Materials	Lower 25%
V. Maternal Involvement with Child	Middle 50%
VI. Opportunities for Variety in Daily Stimulation	Lower 25%

Test Name: *Battelle Developmental Inventory*

<u>Domain</u>	<u>Raw Score</u>	<u>Age Equivalent</u>
Personal-Social	35	10
Adaptive	25	10
Motor	40	10
Communication	19	10
Cognitive	18	10
BDI Total Score	137	10

Subject # 38 CA: 11 months, Sex: F
 Mother: 31, some college, married
 Father: 29, high school
 CA of Brothers: none
 CA of Sisters: none
 People in Home: 3
 Site: Home day care
 Number of Ear Infections: none

 Test Name: *Observation of Communicative Interaction (OCI)*

<u>Question</u>	<u>Scores</u>
1. Appropriate tactile/kinesthetic stimulation	Often
2. Pleasure during mother/infant interaction	Often
3. Responds to child's distress	Often
4. Positions self to allow eye contact	Often
5. Smiles contingently at infant	Often
6. Varies prosodic features	Often
7. Encourages "conversation"	Often
8. Responds contingently to infant	Often
9. Modifies interaction in response to negative cues from infant	Often
10. Uses communication to teach language & concepts	Often

Test Name: *Home Inventory (Birth to 3)*

<u>Subscales</u>	<u>Percentile</u>
I. Emotional & Verbal Responsivity of Mother	Middle 50%
II. Avoidance of Restriction & Punishment	Lower 25%
III. Organization of Physical & Temporal Environment	Middle 50%
IV. Provision of Appropriate Play Materials	Lower 25%
V. Maternal Involvement with Child	Middle 50%
VI. Opportunities for Variety in Daily Stimulation	Middle 50%

Test Name: *Battelle Developmental Inventory*

<u>Domain</u>	<u>Raw Score</u>	<u>Age Equivalent</u>
Personal-Social	35	10
Adaptive	25	10
Motor	44	11
Communication	19	10
Cognitive	18	10
BDI Total Score	141	10

Subject # 39 CA: 11 months, Sex: F
 Mother: 21, 10th grade, single
 Father: 33, 12th grade
 CA of Brothers: none
 CA of Sisters: 6, 4
 People in Home: 4
 Site: Health department parenting class
 Number of Ear Infections: none

Test Name: *Observation of Communicative Interaction (OCI)*

<u>Question</u>	<u>Scores</u>
1. Appropriate tactile/kinesthetic stimulation	Optimally
2. Pleasure during mother/infant interaction	Often
3. Responds to child's distress	Often
4. Positions self to allow eye contact	Often
5. Smiles contingently at infant	Often
6. Varies prosodic features	Often
7. Encourages "conversation"	Often
8. Responds contingently to infant	Often
9. Modifies interaction in response to negative cues from infant	Sometimes
10. Uses communication to teach language & concepts	Sometimes

Test Name: *Home Inventory (Birth to 3)*

<u>Subscales</u>	<u>Percentile</u>
I. Emotional & Verbal Responsivity of Mother	Middle 50%
II. Avoidance of Restriction & Punishment	Middle 50%
III. Organization of Physical & Temporal Environment	Middle 50%
IV. Provision of Appropriate Play Materials	Lower 25%
V. Maternal Involvement with Child	Middle 50%
VI. Opportunities for Variety in Daily Stimulation	Lower 25%

Test Name: *Battelle Developmental Inventory*

<u>Domain</u>	<u>Raw Score</u>	<u>Age Equivalent</u>
Personal-Social	35	10
Adaptive	25	10
Motor	44	11
Communication	19	10
Cognitive	18	10
BDI Total Score	141	10

Subject # 40 CA: 11 months, Sex: M
 Mother: 28, high school, married (separated)
 Father: 37, high school
 CA of Brothers: 8, 5
 CA of Sisters: none
 People in Home: 6
 Site: Family services center
 Number of Ear Infections: 2

Test Name: *Observation of Communicative Interaction (OCI)*

<u>Question</u>	<u>Scores</u>
1. Appropriate tactile/kinesthetic stimulation	Often
2. Pleasure during mother/infant interaction	Often
3. Responds to child's distress	Often
4. Positions self to allow eye contact	Often
5. Smiles contingently at infant	Often
6. Varies prosodic features	Often
7. Encourages "conversation"	Often
8. Responds contingently to infant	Often
9. Modifies interaction in response to negative cues from infant	Sometimes
10. Uses communication to teach language & concepts	Often

Test Name: *Home Inventory (Birth to 3)*

<u>Subscales</u>	<u>Percentile</u>
I. Emotional & Verbal Responsivity of Mother	Middle 50%
II. Avoidance of Restriction & Punishment	Lower 10%
III. Organization of Physical & Temporal Environment	Middle 50%
IV. Provision of Appropriate Play Materials	Lower 25%
V. Maternal Involvement with Child	Middle 50%
VI. Opportunities for Variety in Daily Stimulation	Middle 50%

Test Name: *Battelle Developmental Inventory*

<u>Domain</u>	<u>Raw Score</u>	<u>Age Equivalent</u>
Personal-Social	36	11
Adaptive	27	10
Motor	44	11
Communication	19	10
Cognitive	19	11
BDI Total Score	145	11

Subject # 41 CA: 11 months, Sex: F
 Mother: 30, high school, married
 Father: 39, high school
 CA of Brothers: none
 CA of Sisters: 4
 People in Home: 4
 Site: Home day care
 Number of Ear Infections: 2

 Test Name: *Observation of Communicative Interaction (OCI)*

<u>Question</u>	<u>Scores</u>
1. Appropriate tactile/kinesthetic stimulation	Optimally
2. Pleasure during mother/infant interaction	Often
3. Responds to child's distress	Often
4. Positions self to allow eye contact	Often
5. Smiles contingently at infant	Often
6. Varies prosodic features	Often
7. Encourages "conversation"	Often
8. Responds contingently to infant	Often
9. Modifies interaction in response to negative cues from infant	Optimally
10. Uses communication to teach language & concepts	Often

Test Name: *Home Inventory (Birth to 3)*

<u>Subscales</u>	<u>Percentile</u>
I. Emotional & Verbal Responsivity of Mother	Middle 50%
II. Avoidance of Restriction & Punishment	Middle 50%
III. Organization of Physical & Temporal Environment	Middle 50%
IV. Provision of Appropriate Play Materials	Lower 25%
V. Maternal Involvement with Child	Middle 50%
VI. Opportunities for Variety in Daily Stimulation	Middle 50%

Test Name: *Battelle Developmental Inventory*

<u>Domain</u>	<u>Raw Score</u>	<u>Age Equivalent</u>
Personal-Social	36	11
Adaptive	27	10
Motor	42	10
Communication	19	10
Cognitive	19	11
BDI Total Score	143	11

APPENDIX B
INFORMED CONSENT FORM

TO PARENTS:

My name is Corine Myers-Jennings, and I am a Doctoral Student at the University of Florida. I am currently a candidate for the degree of Doctor of Philosophy in Speech-Language Pathology.

The purpose of this study is to determine one type of babbling in infants 6 to 10 months. During the first visit with your child, he/she will receive a hearing screening and an assessment of cognitive, motor, and communication skills. I will observe your infant and check behaviors that I observe such as smiles, sounds, desire for attention, showing excitement, and feeding habits. I will also ask you questions about things you do while you are feeding, playing, and holding your baby. If your infant is selected, a sample of his syllable activity will be recorded upon notification by you that he/she has started to make syllable sounds. I will come to your home or to your child's day care center and tape his sound making activity. Only the principle investigator (I) and my supervisor will have access to the tapes and will know the identity of your child. The entire procedure will take no more than two home visits with the taping session being no more than one hour.

If your child is between 6 and 11 months and you want him/her to participate in this study, please sign this form. You are free to withdraw your consent and terminate your child's participation at any time. Your child's confidentiality will be protected by using a number in the dissertation or a possible publication of the project. Please sign one copy of the attached form. Keep one for yourself and return the signed copy to me. If you have any further questions about the study, feel free to call me at the below.

Corine Myers-Jennings
P.O. Box 15211
Gainesville, Florida 32604
(904) 334-5852 or 955-6875

I agree that my child _____, may participate in this study, and I have received a copy describing the procedure. I understand that I may withdraw my consent and terminate my child's participation at any time. I have read and I understand the procedure described above. I received a copy of this description.

_____ Parent or Guardian	_____ Date	_____ Relationship
_____ Second Parent or Witness	_____ Date	
_____ Principal Investigator	_____ Date	
_____ Supervisor, Alice T. Dyson, Ph.D	_____ Date	

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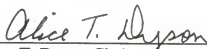
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BIOGRAPHICAL SKETCH

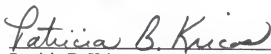
Corine Caroline Myers-Jennings was born on November 6, 1952, to Ethelena and the late Clarence Myers in Lake City, South Carolina. She has one older brother, Ronald W. Myers, who resides in Charleston, South Carolina, with his wife, Bernadine, a daughter, two sons, and a grandson, Tanyanika, Ronald, Tyron, and Sam. She was married in January, 1993, to Elder Patrick V. Jennings. She attended South Carolina State University and received a Bachelor of Arts degree in speech pathology and Audiology in 1974 and a Master of Arts degree in speech pathology and audiology in 1976. She has worked at South Carolina State University for 14 years in several positions, Clinical Director, Clinical Supervisor, and Assistant Professor of Speech Pathology. She enrolled in the doctoral program at the University of Florida in the summer of 1989 and started to collect data for her research in 1992 to 1994. She will receive her Ph.D in communication processes and disorders in December, 1994.

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.



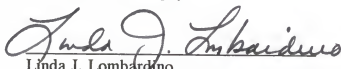
Alice T. Dyson, Chair
Associate Professor of Communication
Processes and Disorders

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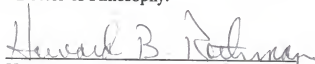
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Linda J. Lombardino
Professor of Communication Processes
and Disorders

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Howard B. Rothman
Professor of Communication Processes
and Disorders

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

A handwritten signature in cursive script, reading "Vivian Correa", written over a horizontal line.

Vivian Correa

Professor of Special Education

This dissertation was submitted to the Graduate Faculty of the Department of Communication Processes and Disorders in the College of Liberal Arts and Sciences and to the Graduate School and was accepted as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

December, 1994

Dean, Graduate School